

Identifying Generic Object-oriented Programming Skills for OOP course using Delphi Technique: Work in Progress

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Abstract: One of the largest challenges facing educators teaching object-oriented courses is deciding how to evaluate each students programming skill. This research focus on how we addressed this challenge in object oriented programming course by proposing a new assessment method to assess students' object-oriented programming skills. The process begins by identifying generic object-oriented skills that students should acquired. In this paper we discuss the approach taken in the process of identifying the object-oriented skills, i.e. Delphi technique. Delphi technique is a structured multi-step process that uses a group of experts to achieve a consensus opinion. We present the methodology of three Delphi processes to identify object-oriented programming skills. The identified skills will be used to guide both the coverage of student learning assessments and can be used by instructors to identify what topics merit emphasis.

Keywords: Object-oriented programming, object-oriented skills, Delphi technique, assessment

Introduction

Object oriented (OO) programming is a key technology for modern computing. Thus, most of Computer Science (CS) and Information Technology (IT) courses include OO programming as one of their core syllabus. The major aim of the course is for students to understand the concepts of OO programming, to design well using OO building blocks and to be able to program proficiently in OO programming languages. Curriculum, pedagogy and assessment are the three basic concepts for teaching programming. Numerous literatures shows that in the early years of programming education, there have been a concern amongst educators on the abilities of student's to program. An international study conducted by McCracken [6] and his group on first year programming students found that the average grade that students achieved when given a programming problem tasks is only 21%. Another study [9] found that quite often students get a good grade in programming, but in practical they failed. Some of them can understand the concept in theory but when it comes to apply it appropriately in their program, they failed.

For most programming courses, students' were expected will learn to program, but there are studies showing that there is no clear notion as to what level of programming skills acquisition our students should attained. Numerous researches have studied the problem of skill acquisition and how to assess student performance, but the research findings have not

been applied widely. In this research rather than focusing on a new teaching technique, the focus is on a new strategy for assessment of programming education [7]. The new assessment approach will facilitate the development of computer programming curricula which existing and new teaching techniques can be more effectively applied and more easily assessed.

Traditional assessment in programming education is with grade. The feedback from industry, government, and professional bodies is that, the grades do not reflect the actual programming skills that the students have acquired [8]. Quite often students get good grades but still facing great challenges at workforce, or have difficulties to take on real programming jobs. As educators, we need a new method to measure our programming educations and not just grades, so that we know the impact of our education on our graduates and their level or real knowledge and skills and their likely contribution dimension to the ICT industries. To achieve these objectives, current CS and IT education approaches must be aligned with new methods of assessment and must capable of empowering and sustaining the assessment process. The assessment must reflect the goals, aims and contents of a course [1][7].

The problem driving this study was the lack of recognized and validated OO skills to be included in programming education program. Therefore, the purpose of this study was to identify, develop and validate the critical OO skills that should be acquired by undergraduate students who took OO programming courses in CS and IT program.

This paper will discuss our first approach in developing the new assessment approach for OO programming courses. We begin by identifying the critical OO skills for OO programming courses by incorporating Delphi technique for data collection. The next section will discuss briefly on Delphi techniques and followed by the implementation of the technique in the research. We conclude the paper with some future work in progress.

1. The Delphi technique

This research incorporated a Delphi technique during the process of data collection. The Delphi was used to consult a body of expert, gather information and formulate a group consensus while limiting the complications and disadvantages of face-to-face group interaction. In our case, the Delphi is used to derive generic OO competencies that students should acquire.

1.1 Introduction on Delphi technique

One of the ways obtaining groups input for ideas and problem-solving is using Delphi technique. The Delphi does not require face-to-face participation, in contrary with focus group discussion approach. It uses a series of designed questionnaires together with information summaries and feedback from preceding responses.

The Delphi technique begins with the initial development of a questionnaire focusing on the identified problem by the initiator. Next step, an appropriate respondent group will be selected and the earlier prepared questionnaire will be mailed to each of them. The respondent will answer the questionnaire independently and they will return it to the initiator. The initiators of the questionnaire will summarize responses received; develop a feedback summary and a second questionnaire for the same respondent group. After reviewing the feedback summary, respondents will continue rate priority ideas included in the second questionnaire, then mail back the responses. The process is repeated until

investigators reach an agreement on a topic that being discussed. A final summary report is the will be issued to the respondent group.

The main features of the technique are anonymity, numeric response and feedback. The advantages of the Delphi techniques us that it allows participants to remain anonymous. Thus everybody will free from any social pressure, personality influence or individual dominance. Another advantage of this technique is that it is not as expensive as focus group discussion. It also able to provide a reliable judgment by selecting a mix of official knowledgeable individuals, who can provide a broad analytical perspective. But this technique also has disadvantages. The judgement maybe from those of a selected of people and may not be representative to the other people. It also more time consuming than the focus group discussion and requires skill in written communication. For this research, we chose this technique during the process of identifying the generic OO skills from the educators.

2. Implementation of Delphi technique

In theory, the Delphi process is usually will be continuously iterated until the consensus is achieved. From numerous literature [2],[5],[4], it has been found that three iterations are often sufficient to collect the needed information and to reach a consensus in most cases. The major objective for this activity is to identify the critical OO skills that students should acquire when learning OO subject. The goal is to obtain feedback from a variety of experts obtaining their ideas and suggestions on the subject through their expert experience. The second aim of this activity is to obtain a detailed description of the on the identified OO skills and to discuss methods for assessing the skills.

2.1. Methodology

The methodological approach that will be used combines theory and practice. In the theoretical part, the fundamental aspects OO programming, as well as its definition, main features, and learning objectives will be reviewed. Additionally, the existing literature will be reviewed to identify the source that can be used as a guideline for identifying the OO skills. During the second stage, an empirical application of the technique will be formulated in order to obtain opinions from OO experts on the measuring of the OO skills. Further stages will be:

a) Selection of experts:

Experts who will participate in this investigation of the Delphi method will belong to one of these three groups:

- Educators from several universities who have experience in teaching OO programming for more than 5 years.
- Experts/Educators or professors who conduct an extensive research on OO domain.
- Representative from several software development companies who involved in object oriented software development.

b) Questionnaire design:

The questionnaire will focus primarily on the following aspects:

- Clarity and comprehension of the object oriented key concept
- Clarity and comprehension of Learning Objectives (LO) for OO programming courses. This LOs are derived from the analysis of LO's as proposed in ACM CC2001[3], a revised version of ACM CC2001 and LO's from OOP courses among Malaysian universities. This LO's will serve as a references or starting point for OO

expert to define a details OO programming skills related to particular LO's. Experts are then will identify the specific OO skills based on the LO's and OO concepts.

c) Delphi applications:

Once the questionnaire is ready, the whole process described above will be implemented (questionnaire sending, reception, feedback, etc). As soon as the consensus is reached, the process will be complete (Refer figure 1).

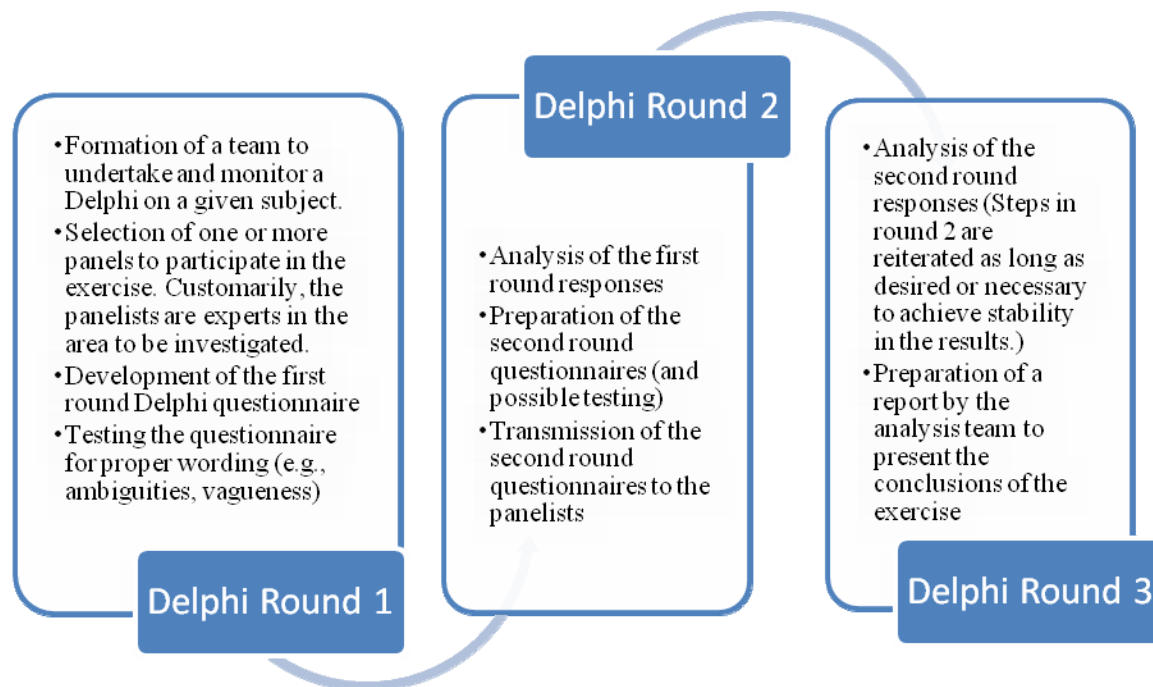


Figure 1: Steps in Delphi Technique

3. Current work – Delphi Round One

Currently we are still conducting Delphi round 1. A few experts in OO has been identified and contacted. These experts mostly have a strong background and experience either in teaching, doing research or development of OO. An invitation letter has been sent to eight (8) experts to participate in this Delphi study. Four (4) educators who have experience more than five years in teaching OO courses, two (2) educators who have more than five years experience doing research on OO and the last two (2) are software developers who involve in OO development for more than five years.

The questionnaire for Delphi Round 1 is also being attached with the invitation letter. Questionnaire in Round 1 is divided into two parts. Part 1 is the process of identifying the key concept for OO programming and setting the weightage for each of the concepts. There are four questions in this section. Question one (Q1) is related with identifying OO concept that CS and IT undergraduates should acquire when completed their OO programming courses by selecting choices listed in the questionnaire. While question two (Q2) is the OO key concept that added by expert and not listed in Q1. Expert is then need to set the weightage for each of the OO concept according to their importance in question three (Q3). The range of the scale is between one to ten points. In question four (Q4), expert need to set the weightage the OO concept that they added in Q2 using the same scale in Q3.

In Part 2, the questions are related with identifying generic skills related with each of OO concepts in Part 1 on how students should apply these concepts in their program source code. Experts will give their opinion based on their expertise and experience during

teaching, doing research or development in OO. Each of the experts is given certain period to complete the questionnaire in Round 1. The period need to be specified in order to make sure the completion of development of the model can be done in time. We are not able to present the result for Delphi Round 1 as we are still waiting the feedback from the experts. Once the feedback are received, we will analyse the data and then proceed to Delphi Round 2 with the same experts involve in Round 1. It is hope that all the experts will be able to complete the task in Round 1 within the timeframe.

4. Conclusion

There has been interest in key skills as outcomes of education for many years now. Defining the full range of generic and transformable skills that are useful for university students is an exhaustive process. In the context of this paper we use the term “generic skills’ to describe the full range of OO skills that are considered to be essential for students who took OOP courses. We present the methodological approach that we used in order to identify the generic OO skills, i.e using Delphi techniques. Currently we are still in Delphi round 1 and still waiting the feedback from the experts.

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