Teaching English Based Programming Courses to English Language Learners/Non-Native Speakers of English

Ashok Kumar Veerasamy 1 and Anna Shillabeer 2
1,2 RMIT University, Vietnam

Abstract. Computer programming languages are designed to communicate instructions to machines. Most programming languages are designed based on the English language, and use sequences of text including words, numbers, and punctuation. Students who are non-native speakers of English are taught programming courses through English as the medium of instruction. This leads to the possible problem that students’ lack of language skills could prohibit learning in computer languages. The aim of this study is to identify the effect of students’ English comprehension on acquisition of programming ability. An overview of current research in this area is discussed and testing methodology created to measure student’s English knowledge on computer programming keywords and secondly to test effect of their programming skills.

Keywords: English as Second Language, English based Programming Languages, Facile Programming.

1. Introduction

This paper analyses the programming ability of students who are non-native speakers of English learning computer programming courses in English at tertiary level. A computer programming language is used to create sets of commands that instruct computers to perform specified tasks. Each programming language has its own set of vocabulary (keywords) and grammatical rules (syntax) that initiate a computer to perform several tasks. There are many programming languages in use today and they are classified by their intended domain use. The programming languages such as, C#, C++, and Java have strong features such as strong type systems and are used by application developers to develop different application software. The software being used by governments, companies, educational institutions, and people have been designed by using programming languages. For example, Java is widely used by programmers to design interactive web pages, game software for mobile phones, and e-commerce applications. MySQL is a Structured Query Language used to “describe and manipulate relational databases” (Widom & Jennifer, 2008). The popular websites such as Facebook, BBC news use MySQL based database for their data management.

Most of the programming courses that are offered by educational institutions are developed based on industry demand and those are English like programming languages or the programming languages that have English like keywords. For example, Java or C++, which are English based programming languages are taught in introductory programming courses in many universities (Krpan & Bilobrk, 2011). Globalization and internalization of curriculum has influenced the instructional language of the educational institutions. Many educational institutions in Europe, Asia and Africa adopted the English language as the medium of instruction at higher education level (Airey, 2011).

The English language has become the “Language of Instruction for Mathematics and Science” and many developing countries changed their educational system policy to teach mathematics and science courses in English. For example, Malaysian educational system changed the medium of instruction to English to teach mathematics and science courses in its schools from the year 2003 (Tan & Lan, 2011). Similarly, the Higher Education Commission in Pakistan reformed their 18 government colleges’ medium of instruction as English. The ministry of Education and Training, Vietnam also encouraged their pivotal tertiary institutions to teach mathematics and science courses in English (Van, 2009).

It is identified that learning to program is difficult one and the students who are non-native speakers of English have difficulties in understanding and remembering the keywords of a programming language. In this context, it is important to examine students’ English language skills in understanding English based
programming language’s keywords are relating to their acquiring programming skills. Hence, this study surveys whether students’ English language proficiency in an academic, specialized context upturn their programming ability or not. Consequently, the following research questions have been designed.

- Is there a relationship between students’ English comprehension when programming and their programming abilities?
- Is language a barrier for a non-native speaker who learns programming languages in English?

2. Literature Review

2.1. English based programming languages

Programming languages popularity is measured based on the number of job advertisements related to that language, books published that teach or describe the language, count of language references, languages that are used to design custom applications for business, and languages that are used to design web applications [6]. The top 10 programming languages such as C, C++, Objective-C, Java, JavaScript, PHP, Perl, Visual Basic, Python, and Ruby were developed in English speaking countries except for Python being developed in The Netherlands and Ruby in Japan (siliconindia, 2012). Another popular programming language called Structured Query Language (SQL) was initially called “SEQUEL -Structured English Query Language (King, 2011) and keywords of SQL are in English (siliconindia, 2012). These programming languages however are also English based languages since their keywords are in English.

There are programming languages that are like natural languages other than English. For example, Łukaszewicz developed a Polish programming language called SAKO (Łukaszewicz L., 1961). Youssef Bassil developed a general purpose C-like Arabic programming language called Phoneix (PhoneixLanguage, 2007). SKT Software Company, located in India, developed a programming language in Hindi called HPL targeting the huge base of over 100 million Hindi speaking people (Technologies, 2007). But to the best of the author’s knowledge such attempts to develop non-English based programming languages have not become popular and not been taught at universities as a key course.

2.2. English as instructional language

The language used as a medium of instruction in teaching is termed an instructional language. Selection of an instructional language has been always important as it is a tool for the student to acquire knowledge and improve their cognitive abilities (Ahemed, 2011), (Kumar, 2011). The instructional language of the classroom must be well known for students that support them to apply “psycholinguistic guessing strategies” (Cummins, 1984) and the students who can deduce the functional meaning of a word or sentence in an academic, specialized context will increase their motivation for learning, and communicating skills (Johnson, 2010).

The English language has become the “global lingua Franca” and/or an international language of communications, science, information technology, and business (Kirkpatrick, 2011). Many fields, occupations, and professions such as medicine and computing require people who have a working knowledge of English. In many countries, English language is adopted as the instructional language especially in Higher Education (Tan & Lan, 2011), (Kirkpatrick, 2011), (Meganathan, 2011) and (Airey, 2011). For example, in Turkey, 26 universities adopted English as a medium of instruction however English is not an official language or second language (Kilickaya, 2006). In Europe, around 2400 courses are offered in English, with the great majority of those being taught in Northern Europe, Germany and the Netherlands (Kirkpatrick, 2011). Hindi and English are official languages of India where the medium of instruction in colleges and universities is English but few schools use other languages as medium of instruction (Meganathan, 2011).

There are articles that attempted to explain instructional language issues. Fischer & Perez said that students may struggle to learn the content in their second language if their academic knowledge is not sufficiently strong in their first language (Fischer & Perez, 2008). The students whose native languages are not English are referred to as English language learners. The student who has limited ‘English proficiency’ may struggle or cannot fully participate in conventional English instruction, and while memorizing
important keywords of a course may help students to do well in exams, it will prohibit the student from linking multiple steps within a process into a coherent whole (Tan & Lan, 2011). Many teachers struggled to deliver their course contents to English language learners in a better way (Matthiasdottir, 2006), (Batt, 2008) and they are always looking for new methods to make it easier for them (Krpan & Bilobjrk, 2011).

There have been limited research studies done on students who learn mathematics and science courses in English. Lesser and Winsor reported that, students who have limited English knowledge will struggle to understand the concepts and may not be able to complete the exercises (Lesser & Winsor, 2009). Tan investigation was, simplifying both language and content for students to help them to understand mathematics or science lessons will decrease their ability to function in the particular domain (Tan & Lan, 2011).

Programming courses have become the core of computer science curricula at educational institutions. Programming courses are also offered to students who are from different disciplines (Elazhary, May 2012). There has been much research done on teaching programming courses in interesting ways. Yaguan’s research listed a few teaching techniques such as case driven teaching, observing the coding criterion, and technique to learn, identifying and implementing teaching methods, and ability training related to industry demand and to teach Java more interestingly and effectively (Yaguan, 2010). However, Programming courses are generally regarded as difficult for students the often experience problems in understanding the concepts and algorithms (Krpan & Bilobjrk, 2011).

According to Elazhary, Facile programming means designing new versions of programming languages that are similar to natural languages for students who are non-native speakers of English that have difficulties in understanding, and remembering the keywords, and syntax of English based programming languages. Elazhary justified that, Facile programming helps novice programmers to learn coding techniques easily as they had to write code by using their native language character set (Elazhary, May 2012). However, according to the author’s observation Facile programming approach makes student native language dependent and the scope of those languages is very limited to the tertiary or country where similar natural languages are in use.

There are different types of coding errors that student commits when he/she is not able to understand the coding technique of the particular programming language. Research suggests that, judgment errors occur when a student cannot understand the compiler error messages and knowledge errors occur when student fails to understand the syntax of the language, and is not able to use keywords or commands, and rules (P.Bringula, A.Manabat, A.Tolentino, & L.Torres, 2012). However, there is relatively little research done on students who commit syntax or using improper keywords and judgment errors due to their lack of English proficiency. Although English language learners problems are frequently investigated, relatively little research done on how they learn programming languages in English or other languages.

3. Method

The objective of proposing this method is to find whether students’ English knowledge of programming keywords and their programming abilities are related with each other. So, it is intended to apply quantitative methods for data collection and data analysis. The quantitative data will be obtained from two tests; an English language test and a programming language test.

- English language test (testing computer language keywords)
  This test is to check the student’s ability in identifying the meaning of programming language keywords in social context. It is expected that, students would use the correct keyword as an answer, which they have learned in the programming languages Java and SQL.

- Computer Language Test
  This test is to check the student’s ability in understanding the functional meaning of the keywords in the computer programming context. Table 2 and describes the keywords of Java and table 3 defines the keywords of SQL with their functional and English meaning. These keywords will be used in the tests.
The tests will be conducted to students from the university, where the English is the medium of instruction and the students from the university where the instructional language is other than English in the end of the semester. Respondents will be asked to enter the details about them to make sure that, they have “Basic English proficiency” and have studied Java and SQL courses.

4. Conceptual framework

Based on the review of literature on English programming languages and instructional language barrier literatures, the following conceptual framework has been created.

Fig. 1: Conceptual model for a testing system

Fig. 1 depicts the unit of analysis and types of tests that will be conducted for students who are non-native speakers of English. Table 1 contains a summary of construct definitions.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection criteria</td>
<td>(i) *Student A – learning programming courses at higher education where the instructional language is other than English.</td>
</tr>
<tr>
<td></td>
<td>(ii) *Student B – learning programming courses at higher education where the instructional language is English.</td>
</tr>
<tr>
<td></td>
<td>*Both types of students are non-native speakers of English</td>
</tr>
<tr>
<td>Independent variables</td>
<td>Previous Education in English - students who have done their secondary education where the medium of instruction is English.</td>
</tr>
<tr>
<td></td>
<td>Bilingual family - Students, who have the ability to speak, write in English that acquired from their parents who are from different nationalities.</td>
</tr>
<tr>
<td></td>
<td>Number of years speaking in English - Students who have learned English due to education policies / social norms/ self-interest.</td>
</tr>
<tr>
<td></td>
<td>Spent few years in English speaking countries - Students, who have spent a few years in English speaking countries and acquired English language proficiency.</td>
</tr>
<tr>
<td>Control variables</td>
<td>(i) English language comprehension test in using programming keywords those are from English.</td>
</tr>
<tr>
<td></td>
<td>(ii) Java and SQL programming language test</td>
</tr>
</tbody>
</table>

Table 1: Construct Definitions
5. Conclusion

This paper developed a methodology to identify the effect of students’ English comprehension on acquisition of programming ability. The paper explained about the English based programming languages, English language teaching issues, and programming courses that are offered at higher education. The proposed methodology and construct definitions are expected to support a conclusion like students’ English proficiency on programming keywords would affect their programming skills or students do better programming if they understand the functional meaning of programming keywords in English. However, this study is not focusing on the student’s ability on complex problem solving, thinking on several levels, and top down thinking skills but basic logical skills and attention to detail.

6. References


