An Impact on Teacher Qualifications on Student Achievement in Science: A Study on the G.C.E (O/L) in Trincomalee District

S. Antony¹, P. Elangkumaran²
Senior Lecturer, Advanced Technological Institute, Trincomalee. Sri Lanka¹
Lecturer, Advanced Technological Institute,Vavuniya. Sri Lanka²

Abstract:
The purpose of this study was to investigate an impact of teacher qualifications on student achievement in science based on the G.C.E (O/L) performance in Trincomalee division. Teacher qualification is very important because of, it directly affects to student performance. Student performance was considered as the dependent variable, and teacher educational qualification, subject major, teaching experience and professional development, were considered as the independent variables. The researcher selected all the teachers who taught science subject for the G.C.E (O/L) classes in the Trincomalee Division for this research study. One questionnaire was used to collect the data from the teachers. 53 questionnaires were distributed among the science teachers in Trincomalee Division. The response rate of the teachers was 100%. The science students achievement were analysis through GCE (O/L) result. The average grade of each teacher’s students was used as the achievement of the teacher’s students. Respondents were analyzed for their level of student’s performance on five point likert scale as the scaling method. The measurement scale for independent variables were “interval”. The data was analyzed using Statistical Package for Social Sciences (SPSS) Version 16. Mean Score and Standard deviation were used for Univariate analysis and correlation and simple regression were used for bivariate analysis. Multiple regressions was used to multivariate analysis. The Hypotheses were tested using the Pearson Product Movement Correlation Coefficient (r) beta value (β) and p value. The result indicated that teaching experience, educational qualification and subject major were strong significant positive predictors of student performance in science. Based on this it can be argued that these factors were highly influenced on the student performance in science. In addition to these three factors (Teaching experience, educational qualification and subject major) and other factor of professional development were also positively and significantly influenced on student performance. The selected four factors have significantly explained 58% variance of student performance in science.

Keywords: Impact, Science Student achievement, Teacher qualification.

I. INTRODUCTION

International virtual studies of educational achievement have become an important source of information for those involved in educational policymaking. To promote student performance in subject, it is important to determine which factors influence students’ achievement. Such an understanding will aid in the development of new interventions for influencing the factors, thus enhancing student achievement in science. Students’ achievement in science depends on a complex relationship of factors both within and outside the classroom. These factors range from teacher’s background - level of education, subject majors and years of experience, to the professional development the teachers have received to support their teaching and to the teaching practices the teachers use to accomplish their teaching, among other factors. Teacher education level and teacher experience, two main attributes of teacher quality, have gained attention, and have been the focus of many investigations. However, results of existing meta-analytic reviews examining the relationship between student achievement and both teacher education level and experience are in conflict, with some suggesting a positive relationship and others suggesting no relationship Goldhaber, (2004). Researchers and policymakers have regarded improving teacher quality as a successful way to improve student achievement (Darling- Hammond, 2002; Greenberg, Rhodes, Ye, &Stancavage, 2004) In addition, the degree to which the relationship between student science achievement and science teacher education level and experience is affected by classroom teacher behaviors has not been sufficiently (Opdenakker &Damme, 2006). Many studies have demon strated a link between the effects of teacher behaviors in the classroom on student achievement (Fraser &walberg, 2005). This link has also been found in the subject of science Walberg, (1986). Among teacher behaviours that have been shown to lead to high student achievement are efficient classroom management skills, systematic teaching approaches, providing clear teaching goals, and using advance organizers Fraser & Walberg, (2005). As Wenglinsky (2002) has suggested, a teacher cannot be determined to be qualified by checking his or her education level, years of experience, or teaching certificate. Teachers influence students through their interactions with them, especially in the classroom. Thus, although important, teacher education level and experience only represent a portion of the ability to manage the classroom efficiently and to promote student achievement. Given the relatively few studies conducted in Sri Lanka as well as there is no study conducted in Trincomalee District on the impact of Teacher Qualifications on Student Achievement. These recommended policies on student learning, and conflicting results obtained from the many studies conducted elsewhere, the study documented in this article attempted to validate some of the assumptions at the basis of the suggested policies. More specifically, the study examined the extent to which Teachers’ Level of Education, Teachers’ Subject Majors, Teachers’ Teaching Experience, and Teachers’ Professional Development - all assumed cardinal teacher qualifications - are indeed associated with student achievement in mathematics and
science. By improving our understanding in these areas, administrators, researchers, and policymakers will better understand which teacher characteristics have the greatest impact on student science achievement. This will also enable researchers and policymakers to design more effective intervention programs to influence teacher behavior.

1.1 Research Problem
Students’ performance in science in Trincomalee division has been very poor when compare with the other part of the country. According to General Certificate of Education Ordinary Level’s (GCE O/L) examination results, the statistics of students’ performance in science subject in Trincomalee division schools for the last two years has been below 38% of credit pass (Table 1.1). This means that less than 38% of the candidates were able to score up to 55% in the subject in the examination. The implication of this is that only a few of the students would be admissible to study science and technology related courses in GCE A/L in Schools and the institutions of higher learning even though the employability opportunity is availability in more than 90% in the country for science-oriented courses.

Table 1. Student Achievement in Science

<table>
<thead>
<tr>
<th>Year</th>
<th>Below credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>62.97</td>
</tr>
<tr>
<td>2016</td>
<td>67.26</td>
</tr>
<tr>
<td>2015</td>
<td>48.43</td>
</tr>
</tbody>
</table>

Problem Statement
Whether the teacher qualifications affect the achievement of students’ performance or not on science subject in the GCE (O/L) examination this study investigated the following research questions based on the problem:

i. To what extent the type of teacher’s level of education do student scores on the science subject at the GCE (O/L) examination.

ii. To what extent the teacher’s total number of years of teaching science do student scores on the science subject at the GCE (O/L) examination?

iii. To what extent according to specialization in science subject do student scores on the science subject at the GCE (O/L) examination differ?

iv. To what extent the professional development by the teacher do student scores on the science subject at the GCE (O/L) examination.

1.2. Objective of The Study
The main objective of the study is to analyze the effects of teacher qualification on student achievement in science subject at GCE O/L examination. In order to materialize this broad objective, the following sub objectives have been considered.

i. To identify the impact of teacher’s level of education on scores on the science subject at the GCE (O/L) examination.

ii. To recognize the effect of teacher’s total number of years of teaching science on student scores on the science subject at the GCE (O/L) examination.

iii. To find the specialization in science subject student scores on the science subject at the GCE (O/L) examination.

iv. To find the impact of professional development by the teacher on the science subject at the GCE (O/L) examination.

II. LITERATURE REVIEW

2.1 Student Achievement
The student performance is effected by various factors. These factors have been to influence student achievement can be categorized into three types: school-related factors, student-related factors, and teacher related factors (Dossett & Munoz, 2003). Among these three, teacher quality is the most important school-related factor influencing student achievement (Rice, 2003). Quality teachers are often seen simply as “good” teachers and are considered to be those who exhibit desirable traits and uphold the standards and norms of the profession. Quality teachers are also considered to be those who bring about “student learning”. These teachers are called “effective” (Berliner, 2005) or “successful” (Fenstermacher & Richardson, 2005). Teacher quality usually refers to these two broad areas: teacher preparation and qualifications, and teaching practices (Lewis, Parsad, Carey, Barfai, Farris, & Smerdon, 1999). Teacher qualification and preparation concerns the inputs that teachers bring to the school, including postsecondary education, certification, prior professional work experiences, subject Major, professional development, demographics and aptitude. Teaching practices involve in the actual quality of teaching that teachers exhibit in their classroom. Some researchers classified teaching practice as teacher quality and teacher preparation and qualification as teacher quality (Kaplan & Owings, 2001). Teaching practices or teaching quality refer to what teachers do to promote student learning, including creating a positive learning climate, selecting appropriate instructional goals and assessments, using the curriculum effectively and know how to use various instructional methods to teach to high standards. “Conceptually, measuring teaching quality ought to be a high priority of any examination of teaching and learning, since, literally defined, it represents the direct effect on students by teachers as they create their classroom magic” (U. S. Department of Education, 1999, p. 1). While teacher preparedness and qualifications may not directly address the actual quality of teaching and student learning, they are necessary prerequisites of effective teaching (Stronge, 2002). Some well-established indicators of teacher preparation and qualifications, such as teachers’ education credentials, their subject knowledge and their certification type, do inform researchers and policymakers in terms of how well-prepared teachers are to take on the assignments they are handed (Lewis, Parsad, Carey, Barfai, Farris, & Smerdon, 1999; Mandel, 1996). According to Stronge (2002), a growing body of research concerning teacher quality has reinforced the notion that both teacher preparation and qualification and teaching practice matter in teaching, in terms of student achievement. In order for a clearer discussion, this study focuses exclusively on teacher preparation and qualification, more specifically, on teacher qualifications as a single aspect of teacher quality. According to this evidence, teacher qualification is one of the major factor to determine the student achievement. The Bush Administration’s proposal, which specifies what defines a “highly qualified” teacher, is based on the premise that teacher excellence is vital to realizing improved student achievement. This legislation, along with typical hiring and compensation systems, assumes that years of teaching experience, teacher certification, engagement in certain types of coursework, and performance on standardized assessments are indicators of high-quality teachers (Rice, 2003).

2.2. Factors Influencing Student Achievement

2.2.1. Teachers’ Level of Education
The teachers’ level of education is crucial factor to determine student achievement. It was categorized according to the highest qualification the teachers obtained, namely Certificate,
Diploma, Bachelors, Masters or Doctoral degrees. A number of studies have examined the ways in which teachers’ highest qualifications are related to students’ achievement. Many of the studies found that teachers’ qualifications correspond positively with students’ achievement. Betts, Zau, & Rice (2003) found that teachers’ highest degree correlates positively with students’ achievement. Rice (2003) found that when teachers have an advanced degree in their teaching subjects it will have a positive impact on the students’ achievements. In addition to No Child Left Behind Act (NCLB) specifies that highly qualified teachers must have minimum of a bachelor’s degree. The studies have focused on whether teachers with a master’s degrees or greater have a significantly greater impact on student achievement (Greenberg, Rhodes, Ye, & Stancav age, 2004).

2.2.2. Teachers’ Subject Majors
Subject matter knowledge is another variable that one might think could be related to teacher effectiveness. Byrne (1983) summarized the results of thirty studies relating teachers’ subject matter knowledge to student achievement. The teacher knowledge measures were either a subject knowledge test (standardized or researcher-constructed) or number of college courses taken within the subject area. The results of these studies were mixed, with 17 showing a positive relationship and 14 showing no relationship, Wilson and Floden (2003) concluded that, in mathematics, there seems to be a trend that the students whose teachers have mathematics or mathematics education degrees demonstrate higher levels of achievement. Other studies also reported that teachers’ subject knowledge had positive relation with student learning (Betts & Frost 2000; Ferguson & Womack, 1993; Hawk, Coble, & Swanson, 1985, Monk & King, 1994).

2.2.3 Teachers’ Teaching Experience
Teacher experience is the number of years a teacher has taught. A several studies found teachers’ years of experience to positively correlate with students’ achievement. Betts, Zau, & Rice (2003) found that teachers’ experience significantly correlates with students’ achievement in mathematics. A report by the Centre for Public Education (2005) stated that research has been consistent in finding positive correlations between teaching experience and higher students’ achievement. Teachers with more than five years teaching experience are found to be the most effective while inexperience is shown to have strong negative effect on students’ performance. Greenwald, Hedges, and Laine (1996) in their meta-analysis of data from 60 studies found that teachers’ years of teaching experience positively correlates with students’ achievement.

2.2.4 Teachers’ Professional Development
Teachers’ professional development refers to the opportunities offered to practicing teachers to develop new knowledge, skills, approaches and dispositions to improve their effectiveness in their class rooms (Loucks-Horsley, Hewson, Love, & Stiles, 1998). Varella (1997), Varella (2000) and Franke (2002) show that teachers’ professional development has positive effects on students’ achievement but the issue is that it has to be long-term. Based on the above empirical evidence, the following hypotheses were developed.

H1a: Teacher qualifications are significantly associated with students’ achievement in science of Trincomalee district students.
H1b: Subject major is significantly associated with student achievement
H1c: Teachers’ years of experience is significantly associated with student achievement
H1d: Professional development is significantly associated with student achievement
H2: Teacher qualifications are significantly impact on student achievement of Trincomalee district students.
H3a: Subject major is significantly impact on student achievement
H3b: Teachers’ years of experience is significantly impact on student achievement
H3c: Teachers’ level of education is significantly impact on student achievement
H4a: Teacher qualifications are significantly impact on student achievement
H4b: Professional development is significantly impact on student achievement

III. MATERIAL AND METHODS

3.1. Research Methodology
It describes research design, population and sampling strategy, data sources, measurement, reliability & validity and mode of analysis. This research will be an explanatory study. The emphasis here is on studying a situation or a problem in order to explain the relationship between variables. The study involves the quantitative approach.

3.2. Population and Sampling Technique
The study population will consist of teachers at schools of Trincomalee District. Even though this study select all the science teacher in 1A/B schools under the Trincomalee division using stratified random sampling.

3.3. Data Sources and Instrumentation
A structured self-administered questionnaire will be used and to collect data from the participants. Primary data will be collected through the questionnaire. It was adapted and included 21 questions of student achievement statements measured on five – point Likert scale (Strongly agree to strongly disagree). The values are recorded as follows: strongly disagree scale 1, disagree scale 2, Undecided scale 3, agree scale 4, and strongly agree scale 5. Secondary data will be collected from research studies, books, journals, newspapers, and ongoing academic working papers. The collected data will be processed and analyzed in order to make the study useful to the practitioners, researchers, planners, policy makers and academicians. Reliability of data is a vital question for all types of research study. The study will be proceed carefully throughout the whole process of data collection. It was mentioned earlier that the primary data were collected through questionnaire. Cronbach Alpha is an important concept in the evaluation of assessment of questioner. This step will undertake to obtain reliable data and information by Cronbach alpha. In addition to the above, the secondary data for the study were mostly drawn from publication bodies. Therefore, these data may be considered reliable for the purpose of this study.

3.4 Decision Rule to Measure the Science student Achievement
To ensure control of the study, the researcher compared students by classrooms using the mean GCE (O/L) score, for the teacher’s classroom on the science section of the GCE (O/L) examination.
The mean value of these five point scale was 3. \([5 + 4 + 3 + 2 + 1]/5\) Therefore, the following decision rules were formulated for each variable. “\(\mu\)” denotes the mean score of the respondents for each variable.

- If \(0 < \mu > 1\), then very poor student achievement
- If \(1 < \mu > 2\), then poor achievement
- If \(2 < \mu > 3\), then moderate level of student achievement
- If \(3 < \mu > 4\), then good student achievement
- If \(4 < \mu > 5\), then very good student achievement

### 3.5 Variables:

Student achievement in science, is considered as dependent variable, teacher level of education, subject major, teachers’ years of experience and professional development are considered as independent variables.

### 3.6 Mode of analysis

Descriptive statistics, Pearson product moment correlation and multiple regression methods were employed to analyze the collected data. Figures obtained from SPSS 16.0 were interpreted to come at conclusion and implications.

Student achievement = \(B_0 + B_1*\text{teacher level of education} + B_2*\text{subject major} + B_3*\text{teaching experience} + B_4*\text{professional development} + \epsilon\)

### 4. RESULTS AND DISCUSSION

#### 4.1. Descriptive Analysis

Descriptive statistics provide a statistical summary of the data which has been collected. The descriptive statistics considered appropriate for this research includes percentages, means and standard deviation. There are four independent variables in this research study. The descriptive statistics computed for these variables was indicated in table 2. According to the statistics, there was no significant difference between mean scores of each variable. All independent variables as shown below the mean value. According to the decision rule that was prepared earlier, it mean value falls in to 1< \(\mu\) > 2 poor achievement and 2 < \(\mu\) > 3 moderate level achievement. Professional development only slightly lower means score as 1.64. Educati onal qualification, subject major and teaching experience scales reported lower mean scores as 2.19, 2.09 and 2.70 respectively.

The data shows that the mean value of student performance in science is 2.75. According to the decision rule that was prepared earlier, this mean value falls in to 2 < \(\mu\) > 3 mean value category. That means the student performance are moderate level in science subject. It is clear show most of the students does not have enough qualification to select science stream.

### 4.2. Correlation Analysis

The results presented in table 3 indicate that the correlation coefficients for each research variable. The relationships between impact on teacher qualification and student achievements in science are direct, strong and positive. Correlations coefficients were calculated to describe the relationships between student achievement in science and independent variables (level of education, subject major, teaching experience and professional development). As shown in the table 3 the value of Pearson correlation (\(r\)) between the student achievement in science and independent variables were; teaching experience, 0.674; level of education, 0.553; subject major, 0.506; and the professional development, 0.239. This relationship was statistically significant as the correlation was at 0.01 levels (1- tailed). Teaching experience, level of education and subject major were significantly and strongly positively correlated with student achievement in science in school of Trincomalee division. Professional development was significantly and weak positively correlated with student achievement in science.

### 4.3. Regression analysis of variables

The data shows that the mean value of student performance in science is 2.75. According to the decision rule that was prepared earlier, this mean value falls in to 2 < \(\mu\) > 3 mean value category. That means the student performance are moderate level in science subject. It is clear show most of the students does not have enough qualification to select science stream.
4.3. Multiple Regression analysis

A standard multiple regression model which simultaneously included all the independent variables (Level of education, subject major, teaching experience and professional development) were constructed to determine how much of the variance in the student achievement in science is explained by all the independent variables. The R square indicates how much of the variance in student achievement in science is explained by the model and the Beta value give an idea about the contribution of each independent variables (Table 4). It was found that the model explained 57.5% of variance in student achievement in science. This was statistically significant at p<0.000 (Table 5) Comparing the contribution of the each factors, the factor, Teaching experience and level of education with the largest beta coefficient (0.627 and 0.447), made the highest contribution to explain the student achievement, when the variance explained by all other student achievement factors in the model was controlled for. As shown in the table 05, the other factors (professional development) also significant in contributing to the predation of student achievement. Their significant values were significant at the 0.01 level.

Table.5. Multiple Regression Independent Variable and Job Satisfaction

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.758*</td>
<td>.575</td>
<td>.539</td>
<td>.70331</td>
</tr>
</tbody>
</table>

5. CONCLUSION

The main objective of this research is to identify the impact of teachers’ qualification and student achievement in GCE (O/L) science in schools of Trincomalee division. The researcher identified four factors that can be used as predictors of student performance in science under the literature review. They were teacher educational qualification, subject major, teaching experience and professional development. The research was designed and hypotheses were formulated accordingly. One questionnaire was used to collect the data from the teachers who working in the schools of Trincomalee division. The teacher qualification and which factors are highly affected their students’ performance were examined. According to the findings, the science students of Trincomalee division were not satisfied with their performance in science. They have moderate level of student performance in science. In addition to this finding, a strong positive relationship was found between teaching experience and student performance, educational qualification and student performance, subject major and student performance. The relationship between professional development and Student Performance is weak positive relationship. All the relationships were significant at the 0.01 significant level. Therefore it can be concluded that teaching experience, educational qualification and subject major were strong significant positive predictors of student performance in science. Based on this it can be argued that these factors were highly influenced on the student performance in science. In addition to these three factors (teaching experience, educational qualification and subject major) and other factor of professional development were also positively and significantly influenced on student performance. The selected four factors have significantly explained 58% variance of student performance in science. This study may serve as a base for future studies in different higher education on a larger scale. Further analysis of data is needed, as there are numbers of issues that can be explored further.

6. REFERENCE


