Examining the Influence of University Teachers’ Qualification and Experience on Students’ Academic Achievement in Mathematics

Sonam Gyeltshen1*

1Jigme Namgyel Engineering College, Royal University of Bhutan, Samdrup Jongkhar, Bhutan.

Author’s contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Abstract

Aims: This study aims to examine the effect of qualification and experience level on students’ academic achievement in mathematics in five colleges under the Royal University of Bhutan.

Study Design: It is a quantitative study where the researcher tests the significance of the difference in the mean academic achievement of the students concerning teachers’ qualifications and experience level.

Place and Duration of Study: Five colleges under the Royal University of Bhutan spread across five districts in Bhutan were considered for the study between July 2020 and July 2021.

Methodology: A sample of 25 university mathematics teachers (21 males, 4 females) who taught mathematics from 2018 to 2020 were selected through a simple random sampling. The data was collected in two parts: one the mathematics marks of the modules taught by the 25 teachers from the year 2018 to 2020 was obtained from the respective college's exam records through an official correspondence; second, the information on the perception of these 25 teachers was obtained online through self-administered survey questionnaires.

Results: The result from the two way ANOVA revealed no statistically significant difference between qualifications (Masters and PhD) on students’ academic achievement (F (1, 19) = 3.653, P = 0.07) and between experience levels on students’ academic achievement (F (3, 19) = 0.493, P = 0.69). In contrast, the
perception of the teachers is that the higher level of qualifications and experience levels would have a more positive effect on students’ academic achievement.

Conclusion: The qualification and experience have a positive effect on students academic achievement but the effects are not significant.

Keywords: Academic achievement; qualification; experience level; hypothesis; descriptive statistics; inferential statistics.

Abbreviations

RUB : Royal University of Bhutan;
STEM : Science, Technology, Engineering and Mathematics;
ANOVA : Analysis of Variance;
SPSS : Statistical Package for Social Science;
M : Mean;
SD : Standard Deviation.

1 Introduction

1.1 Background

Under the Royal University of Bhutan (RUB), there are 10 colleges each of which has its area of focus. Out of these 10 colleges, the mathematics modules are being taught in seven colleges. The university attaches paramount importance to the academic achievement of the students while it also promotes a wholesome education. Mathematics being a STEM subject is deemed important elsewhere and in Bhutan too. Teachers and students alike are aware of its importance and applications. Mathematics in some RUB colleges is being offered as a programme while other colleges study just as a module. The colleges like Sherubtse offers four years B.Sc Mathematics and B.Sc Statistics programmes while other six colleges without mathematics programmes offer modules like engineering mathematics, mathematics education, business mathematics and other non-hardcore mathematics. Therefore, the distribution of mathematics teachers is not uniform across the colleges. The colleges offering the programmes have more mathematics teachers than the ones just offering as a module. This also points to the fact that in the colleges where there are no mathematics programmes the importance attached to the subject would also be less.

Comparatively the university has the diversity in qualifications and experience levels of its teachers. However, when it boils down to an individual subject the university is still facing difficulties in getting individuals with the right kind of qualification and experience level. From the pre-survey done for this study, there were around 35 mathematics teachers across the colleges and positively majority of the mathematics teachers had masters followed by PhD qualifications. On the other hand, the academic achievement of the students is an important measure of the quality of education. On this front, there are many similar studies done where the findings are quite divergent.

Goldhaber posits that the teacher's qualification and teaching experience are the most widely studied teacher’s attributes as these would commensurate their salary and some other benefits [1]. Also, the RUB has reformed a career structure for its university teachers with the intention that the best ones are attracted to the teaching profession while the experienced ones are retained in the system [2]. This indicates that there is so much focus on recruiting qualified and experienced university teachers. Therefore, this study investigates if there is a difference in the mean academic achievement of the students in mathematics as a result of differences in qualifications and experience levels of the teachers. So, that the findings from the study will inform the decision-makers.
1.2 Problem statement

Given an improved high level of global education standards, a university should have well qualified and experienced university teachers. Ideally, at least a master's qualification and a certain year of experience in teaching. In this line, the RUB is doing everything at its end, to recruit qualified and experienced university teachers with the aspiration to improve the quality of education. However, the university is still facing its share of challenges in recruiting well qualified and experienced teachers given its unavailability in the job market. The majority of the recruits are young ones who had just freshly passed out from colleges without a required qualification or prior teaching experiences. This issue is even more aggravating when these recruits with no professional training on teaching skills, teaching strategies, and teaching methods are directly sent to colleges. The Royal University of Bhutan in its Strategic Plan Document profess that a huge number of fresh undergraduates that is 127 in 2016 were teaching undergraduate programs in colleges and that for them, was a major source of concern as that would compromise the quality of teaching and learning [2]. The document also stresses that it is difficult for RUB to get quality academics with the right level of qualification, as there is a lack of qualified applicants whenever the announcement for various academic positions is being made. As of 2019, RUB has 550 academics staff of which 5 are with Diploma qualification, 125 with Bachelor's degree qualification, 362 with Master's degree qualification, and 58 with PhD qualification [3]. Further, 80% of the programs under RUB colleges are undergraduate level and contrastingly 24% of the academics combined, have just undergraduate or diploma qualifications [1].

This issue merits serious consideration by concerned stakeholders because its implications would not only be endured by the individual learners and an organization but would permeate beyond. When the students are being taught by underqualified and inexperienced teachers there arises a natural doubt on the compromisation that it could have on imparting a quality teaching and learning, given that the university teachers requires teaching skills to teach adults, sound content knowledge, and professionalism in teaching which only comes by having a right qualification added by experiences. Lack of this will translate to poor academic achievement by students. At the national level, it may create room for people to speculate on the quality of education in the country. When there is a reservation on the quality of teaching and learning at tertiary institutions, there arises a bigger question on the quality of graduates being produced and the scope of employability of those graduates. When recruits do not have the required qualification they are sent for up-gradation after recruiting into the system wherein in some cases are upgraded on the expenses of RUB or the concerned colleges. This could result in a financial implication as well as a human resource implication to the organization which otherwise is avoidable if recruited with at least a master’s qualification. Moreso, it is a financial burden to the country at large.

Recruiting faculties with a master's qualification or with some experience in teaching could be a needful decision so that students and organizations at large could derive an instant benefit without having to invest so much on recruits on up-gradation which could result in bigger financial implications. Considering the above-mentioned implications, this study aspires to examine if there is an influence of university teachers’ qualifications and experiences on the academic achievements of students. Doing this will help the relevant stakeholders to make informed decisions and take up appropriate interventions.

1.3 Research questions

1. Do the university teachers’ qualifications influence students' academic achievement in mathematics?
2. Does the university teachers’ experience influence students' academic achievement in mathematics?
3. Do the university teachers’ qualifications and experience have combined influence students' academic achievement in mathematics?
4. What perception does the university teachers hold on the influence of qualification and experience on students' academic achievement in mathematics?

1.4 Research hypothesis

H0: There is no statistically significant difference in the mean academic achievement of the students when taught by university teachers of different qualifications.
H1: There is a statistically significant difference in the mean academic achievement of the students when taught by university teachers of different qualifications.
H0: There is no statistically significant difference in the mean academic achievement of the students when taught by university teachers of different experience levels.
H1: There is a statistically significant difference in the mean academic achievement of the students when taught by university teachers of different experience levels.

2 Literature Review

In the context of this research, the qualification will be referred to as the highest academic or educational attainment by teachers with relevant subject specialization in their field of study. The qualification will be categorized into three, namely: bachelor’s, Master’s, and PhD. Likewise, the experience will be referred to as the number of years of contact teaching experience a teacher has, in a formal classroom setting.

Teachers are at the core of the teaching and learning ecosystem. Teachers’ characteristics such as qualification and experience are some of the important factors among many that possibly could influence students’ academic achievement. In the context of this research, the influence may either come from qualification or experience, or these two characteristics combined. In this line, there are some related studies done on the influence of qualification and experience on students' academic achievement. While much of the literature suggests teachers’ qualifications and experience having a positive influence on students’ academic achievement, some literature suggests otherwise.

University teachers are presumed to have qualifications with specific subject specialization. Teachers with advanced qualifications such as Master’s and PhD must have specific subject specialization and in-depth content knowledge than ones with a bachelor’s degree. Many studies were done to examine the influence of qualification on students’ academic achievement in different subjects. However, the results are contentious. In all of those studies, researchers had established some form of relationship between the two variables that are teachers’ qualifications and students' academic achievement. A study done by Richardson [4] indicated that there exists a significant relationship between these two variables. This finding is further augmented when Darling-Hammond [5] established that there is a positive but less strong correlation between teachers' qualifications and students' academic achievement. While much of the literature suggests teachers’ qualifications and experience having a positive influence on students’ academic achievement, some literature suggests otherwise.

Rice [9] posits that there is a significant and positive influence of teachers’ experience on students’ academic achievement. This is because experienced teachers would have mastered the content and well-acquired classroom management skills to deal appropriately with any kind of classroom issues [10]. Additionally, some other literature says that experienced teachers would adapt their teaching styles that would appropriately cater to students’ differing abilities, prior knowledge, and background. Encouraged by this, other researchers went further to investigate how many years of experience would have such influence. According to Rivkin, Hanushek [11] the “beginning teachers and to a lesser extent second and third-year teachers in mathematics perform significantly worse than more experienced teachers”. Furthermore, stressed that the positive influence of teachers is significant at four or five years of teachers’ career. On the contrary, teaching experience affects students' achievement positively until years 5-8 [12]. After which the teachers influence students’ achievement levels off and decrease thereafter [11]. The cause for this possibly could be burnout or the promotion of better teachers out of the classroom [13].

Yusuf and Dada [14] have done a study on a similar topic in the Nigerian context. Their participants were twenty University English teachers and a hundred students who were taking English as a course in two education colleges situated in the same state. Data was collected through a quantitative approach and t-test analysis used for data analysis. The findings were that teachers' qualifications significantly influence students’ academic achievement and students taught by teachers with 6-5 years of experience achieve higher than students
taught by 1-5 years of teaching experience. Their findings are conclusive although the study site was just confined to one state with participants from only two colleges. The study site should have been more spread to account for differences in academic achievement that is inconspicuously contributed due to the difference in the state of socio-economics level of the study area. The findings could have been no different if the study site was a higher-rated academic area or a more socio-economically developed state. Therefore, to balance this affect the current study under consideration would consider selecting colleges that not only have mathematics in their curriculum but are spread across the country. Further, as there is a dearth of literature on such topics in the context of Bhutan, this study will be of its kind to initiate to build up the literature. Towards this end, this study will attempt to examine the influence of two observable and measurable variables like qualification and experience on students’ academic achievement.

3 Methodology

3.1 Paradigm Theory

This research is positioned from the perspective of the positivist view. The positivist views researcher as an independent entity from the study; knowledge is generated by following a scientific approach; objectively collects data in the form of facts and figures that can be statistically analyzed to draw meaning or establish a relationship between different variables.

3.2 Study Site

This study covered some of the RUB Colleges where the mathematics modules are being taught. Of the seven colleges where mathematics is being taught the researcher have considered only five colleges for the study as getting a response from some colleges were difficult due to the COVID-19 situation in Bhutan. Thus, this study considered five colleges under the Royal University of Bhutan and are spread across five districts in the country.

3.3 Sampling Size

The study populations were mathematics teachers and the students they taught from the five colleges. A simple random sampling was considered for the selection of 25 mathematics teachers from five colleges out of around 35 mathematics teachers and their respective students.

3.4 Data Collection Method

The data collected were students’ academic marks from the year 2018 to 2020 of the respective teacher participants and the perception survey of the teacher participants. The students’ academic marks of the 25 teacher participants were obtained through official correspondence with the respective colleges while the perception survey was done through online correspondence. For the survey, the instrument for data collection is a self-administered questionnaire that was categorized under two sections. The first section contained items on demographic details such as age, college name, position, year of experience, and qualification and the second section contained items on the perception of teachers on teachers’ qualifications and experience on students’ academic achievement in mathematics. The second section was to particularly examine the perception of teachers on the influence of qualification and experience level on students’ academic achievement. There were 10 items on a five-point Likert Scale of strongly agree, agree, neutral, disagree, and strongly disagree. The questionnaire not only helps understand the agreement level in perception towards each item but also help the researcher understand the variation in the perception against each item. Out of 10 items, five items were on the perception of teachers on qualification (Table 7) and another five items on experience (Table 8). Some items were derived from the literature reviews while some items were constructed in consultation with the research experts so that the items can measure as intended the perception of teachers. Before the administering of the main survey, the questionnaires were piloted to few mathematics teachers who were not involved in the main study to ensure the validity and reliability of the questionnaires.
3.5 Data Analysis

Data collected were analyzed using the SPSS. The data collected through questionnaires were entered into SPSS to run both descriptive and inferential statistics. When descriptive statistics were of help to describe the variables associated with the participants, inferential statistics like factorial ANOVA were used in inferring the results to the population under study. The use of both had helped to cover up the hind side of each other. Factorial ANOVA was chosen for analysis in this study as there are two independent variables such as qualification and experiences and dependent variable students’ academic achievement. The independent variable that is qualification had two levels and experience five levels. The data was collected in the form of academic achievement of all the respective students taught by the 25 teachers from 2018 to 2020. The academic mean achievement for each teacher was calculated before further analysis. The mean academic achievement of the students was entered into SPSS to run factorial ANOVA.

The following is the statistics of teachers by qualification and experience level. It gives us a glimpse of the numbers of mathematics teachers falling into different categories of qualifications and experience levels (Tables 1 and 2).

| Table 1. Number of teachers by qualification levels from 2018 - 2020 |
|---------------------------------------------------------------|
| Qualification       | Number of teachers |
|---------------------|--------------------|
| Master             | 22                 |
| PhD                | 3                  |

| Table 2. Number of teachers by experience levels from 2018 - 2020 |
|---------------------------------------------------------------|
| Year of experience | Number of teachers |
|---------------------|--------------------|
| 0-4yrs              | 0                  |
| 5-9yrs              | 7                  |
| 10-14yrs            | 5                  |
| 15-19yrs            | 2                  |
| 20+                 | 11                 |

4 Results and Discussion

4.1 Results from Descriptive Statistics

The result from the descriptive statistics showed the academic achievement of students when taught by university teachers with PhD (M = 71.87, SD = 5.108) and Masters (M = 62.74, SD = 6.148) (Table 3).

| Table 3. Difference in academic achievement by the qualifications |
|------------------------------------------------------------------|
| Qualification | N | M       | SD    |
|----------------|----|---------|-------|
| PhD            | 3  | 71.870  | 5.108 |
| Masters        | 22 | 62.740  | 6.148 |

The result from the descriptive statistics showed the academic achievement of students’ when taught by university teachers with varying experience level of 5-9 yrs (M = 63.51, SD = 5.108), 10-14 yrs (M = 62.38, SD = 5.912), 15-19 yrs (M = 58.05, SD = 2.192), and 20+ yrs (M = 65.75, SD = 8.071) (Table 4).

| Table 4. Difference in academic achievement by the experience level |
|-------------------------------------------------------------------|
| Experience Level | N | M       | SD    |
|-------------------|----|---------|-------|
| 5 - 9 yrs         | 7  | 63.510  | 5.027 |
| 10 – 14 yrs       | 5  | 62.380  | 5.912 |
| 15 – 19 yrs       | 2  | 58.0500 | 2.192 |
| 20+ yrs           | 11 | 65.750  | 8.071 |
4.1 Results from inferential statistics

To infer the findings of this study to the study population the researchers employed inferential statistics such as a factorial ANOVA. In this study, there were two independent variables such as qualification and experiences and one dependent variable that is students’ academic achievement. The independent variable that is qualification had two levels (Masters and PhD) and experience five levels (0-4 yrs, 5-9 yrs, 10-14 yrs, 15-19 yrs and 20+ yrs). Prior to conducting the ANOVA test, the assumptions of normality were evaluated and the data was found to be satisfying the assumption. Furthermore, the assumption of homogeneity of variance was tested and satisfied based on Levene’s F test ($F (4, 19) = .662, p = .626$).

This study conducted factorial ANOVA to test the above-mentioned hypothesis. The result of the ANOVA showed no statistically significant difference between qualifications (Masters and PhD) on students’ academic achievement ($F (1, 19) = 3.653, P = 0.07$) (see Table 5). The first null hypothesis that there is no statistically significant difference in the academic achievement of the students when taught by university teachers of different qualifications would fail to be rejected. The result of the ANOVA also showed no statistically significant difference between experience levels (0-4 yrs, 5-9 yrs, 10-14 yrs, 15-19 yrs and 20+ yrs) on students’ academic achievement ($F (3, 19) = 0.493, P = 0.69$)(see Table 5). The second null hypothesis that there is no statistically significant difference in the academic achievement of the students when taught by university teachers of different experience levels would fail to be rejected. The interaction effect of qualification and experience level is not statistically significant ($F (1, 19) = 0.007, P = 0.94$) (Table 5). Therefore, this indicates that there is no combined effect of university teachers' qualifications and experience level on the students' academic achievement in mathematics.

### Table 5. Two way ANOVA result

| Source               | Type III sum of squares | df | Mean square | F     | Sig   | Partial Eta squared |
|----------------------|-------------------------|----|-------------|-------|-------|--------------------|
| Corrected Model      | 288.761*                | 5  | 57.752      | 1.412 | .27   | .271               |
| Qualification        | 149.451                 | 1  | 149.451     | 3.653 | .07   | .161               |
| Experience Level     | 60.537                  | 3  | 20.179      | .493  | .69   | .072               |
| Qualification *      | .276                    | 1  | .276        | .007  | .94   | .000               |
| Experience Level     | 777.375                 | 19 | 40.914      |       |       |                   |

*R Squared = .271 (Adjusted R Squared = .079)

4.2 Perception of university teachers on qualification and experience level

Based on the mean and standard deviation, the most agreeable statement on the perception related to qualification: the university teacher's qualifications can influence the student's academic achievement in mathematics ($M = 4.541, SD = .508$); the university teachers with higher qualifications such as Masters or PhD would have a more positive impact on the students' academic achievement in mathematics ($M = 3.958, SD = .999$) and the university teachers with higher qualifications such as Masters or PhD would have in-depth content knowledge ($M = 4.333, SD = .701$) (Table 7).

### Table 6. Agreement level scores

| Levels              | Scale | Interval Length | Interval     |
|---------------------|-------|-----------------|--------------|
| Strongly Disagree   | 1     | 0.800           | 1.000-1.800  |
| Disagree            | 2     | 0.800           | 1.800-2.600  |
| Neutral             | 3     | 0.800           | 2.600-3.400  |
| Agree               | 4     | 0.800           | 3.400-4.200  |
| Strongly Agree      | 5     | 0.800           | 4.200-5.000  |
Table 7. Scores of agreement level on the perception of the teacher on qualification

| Items | Qualification                                                                 | N   | M     | SD   |
|-------|------------------------------------------------------------------------------|-----|-------|------|
| 1     | The university teacher's qualifications can influence the student's academic achievement in mathematics. | 24  | 4.541 | .508 |
| 2     | The university teachers with higher qualifications such as Masters or PhD would have a more positive impact on the students' academic achievement in mathematics | 24  | 3.958 | .999 |
| 3     | The university teachers with higher qualifications such as Masters or PhD would have in-depth content knowledge | 24  | 4.333 | .701 |
| 4     | The university teachers with higher qualifications such as Masters or PhD would have a better pedagogical knowledge | 24  | 3.250 | .989 |

Based on the mean and standard deviation, the most agreeable statement on the perception related to experience level: the university teacher's teaching experience can influence the students' academic achievement in mathematics (M = 4.333, SD = .761); there would be differences in the academic achievement of the students in mathematics when taught by the experienced teachers and inexperienced teacher (M = 4.166, SD = .701) and the experienced teachers would adapt their teaching styles that would appropriately cater to students’ differing abilities, prior knowledge, and background (M = 4.166, SD = .963) (Table 8)

Table 8. Scores of agreement level on the perception of the teacher on experience level

| Items | Experience                                                                 | N   | M     | SD   |
|-------|----------------------------------------------------------------------------|-----|-------|------|
| 5     | The university teacher's teaching experience can influence the students' academic achievement in mathematics. | 24  | 4.333 | .761 |
| 6     | There would be differences in the academic achievement of the students in mathematics when taught by experienced teachers and inexperienced teachers. | 24  | 4.166 | .701 |
| 7     | The experienced teachers would have a significant positive impact on the students' academic achievement than the novice teachers. | 24  | 4.000 | .780 |
| 8     | The experienced teachers would adapt their teaching styles that would appropriately cater to students’ differing abilities, prior knowledge, and background. | 24  | 4.166 | .963 |

4.3 Discussion

The results from the descriptive statistics suggested a difference in the mean academic achievement of the students with higher mean academic achievement when taught by teachers with PhD qualifications than Masters’ qualification. However, further analysis with factorial ANOVA indicated no significant difference in the mean academic achievement between qualifications. This finding is similar to the findings reported by Rowan, Correnti and Miller on the effect of advanced degrees on students’ academic achievement [15].

The results from descriptive statistics revealed the increase in the mean academic achievement of the students with an increase in teachers experience level. However, further analysis with factorial ANOVA indicated no significant difference in the mean academic achievement of the students between different experience levels. However, according to Darling-Hammmond if the comparison has to be drawn between the qualifications and experience level the latter would be more influential to students’ academic achievement [5].

On contrary to the findings from the inferential statistics the findings from descriptive statistical analysis of the perception of the teachers indicated that the perceptions of teachers are that the higher level of qualifications and experience levels would have a positive influence on students academic achievement.
5 Conclusion

This study concludes that the university mathematics teachers’ qualifications and experience level had a positive effect on students’ academic achievement but the effects are not significant. On the other hand, the university mathematics teachers had the perception that the qualification and experience level influenced the students’ academic achievement.

Competing Interests

Author has declared that no competing interests exist.

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