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Characterization of particle mass and number concentrations for a rural location in Eastern Bhutan

Tenzin Wangchuk

Abstract

Air quality in rural areas can be influenced by a number of significant sources. To date only limited studies have characterized and quantified air quality in rural areas. Further, available studies have mostly focused on particle mass, with practically no studies reporting particle number concentrations. This study quantified particle mass and number concentrations in a representative rural location in eastern Bhutan during the typical dry season, using portable real-time instrumentation. For particle mass, results presented a significant variability of daily mean concentrations, with an overall mean concentration of 71 ± 42 μg/m^3 for PM_{10} and 58 ± 32 μg/m^3 for $PM_{2.5}$, which were higher than the respective World Health Organization (WHO) guidelines. Particle number concentrations presented similar results, with an overall mean of 1.14×10^4 ± 5.46×10^3 particles/cm^3, which was comparable with typical ambient concentrations in urban areas. Analysis of daily time-series concentrations presented peak concentrations on certain hours of the day, coinciding with the cooking time near the monitoring site. The findings of this study highlight significant air quality problems in the study area, necessitating more detailed and longer-term investigation to assess associated health outcomes.

Keywords: *Particle mass, Ultrafine Particles, Rural, Air pollution*

List of Acronyms

CF	Correction Factor
CO	Carbon monoxide
CO_2	Carbon dioxide
CPC	Condensation Particle Counter
HAP	Household Air Pollution
NEC	National Environment Commission
nm	Nanometer
NT	Nano Tracer
PM_{10}	Particles with diameter less than 10 microns
$PM_{2.5}$	Particles with diameter less than 2.5 microns
PNC	Particle Number Concentration
WHO	World Health Organization
UFP	Ultrafine Particles
μg	Microgram
μm	Micrometer

Introduction

Air pollution presents major public health risks throughout the world. Particulate matter[1],

1 *Airborne particles are mostly measured as mass concentrations, i.e. PM_{10} (coarse particles, < 10 mm) and $PM_{2.5}$ (fine particles, < 2.5 mm), and as particle number (PN) count, mainly in ultrafine particles (UFPs, < 0.1 mm). Primary sources of coarse particles in the outdoor air are construction activities, farming, mining, wind storms and resuspension of dusts by wind and vehicular traffic (Jantunen et al., 1999; Pope III & Dockery, 2006). The chemical composition of coarse particles typically range from soil minerals to array of non-volatile organics (Jantunen et al., 1999; Morawska & Zhang, 2002). Fine particles in the outdoor environments are introduced by combustion activities such as fossil fuels (by vehicles, power plants and industries), and biomass (D'Amato, Liccardi, D'amato,*

consisting of a complex mixture of solid particles and liquid droplets with varying physical and chemical characteristics is to a large extent responsible for many adverse health effects. Association between particulate matter with mortality and morbidity from respiratory and cardiovascular diseases, exacerbation of asthma, chronic bronchitis, and increased hospital admissions have been reported by several studies, for example (D'Amato et al., 2002; Pope III & Dockery, 2006; WHO, 2006). Other studies have inferred that health effects of ultrafine particles (UFPs), measured as particle number concentration (PNC) while less known, are potentially more harmful than particle mass (Franck, Odeh, Wiedensohler, Wehner, & Herbarth, 2011; Oberdörster et al., 2004; WHO, 2005). This is because UFPs have a high alveolar deposition rate with a large surface area and the potential to translocate into the blood stream (Buonanno, Marini, Morawska, & Fuoco, 2012).

The majority of the available air quality studies throughout the world have focused on urban environments with only a handful of studies reporting air quality characterization in rural areas. While portability of complex instrumentation was a major limiting factor, air quality in rural locations is generally perceived to be clean, thereby drawing less attention from people. Two key questions warrant consideration: (1) How clean is the clean air? (2) How does the pollution level in rural areas compare with international standards and threshold values? While there may be fewer industrial and mobile pollution sources in rural areas, air quality is often affected by long-range transport of urban and regional pollutants. A notable example is ozone (O_3), with generally higher concentrations in rural areas compared to urban environments due to photochemical oxidation of primary pollutants (Bozkurt et al., 2015). Further, farming activities leading to combustion of agricultural residues and other biomass in rural areas have the potential to affect the local air quality adversely. In fact, the highest pollution levels have been reported from indoor environments in rural areas due to household use of solid fuels for cooking and heating, for example (Balakrishnan, Sambandam, Ramaswamy, Metha, & Smith, 2004; Li et al., 2012; Singh, Tuladhar, Bajracharya, & Pillarisetti, 2012). The events and activities defined above could lead to pollution levels exceeding the local and international standards, substantially contributing to the burden of disease to rural population.

The author and co-workers have previously reported several air quality findings from indoor and outdoor environments from rural locations in Eastern Bhutan, including the on-road air quality for the entire East-West Highway (Wangchuk, He, Dudzinska, & Morawska, 2015; Wangchuk, Knibbs, He, & Morawska, 2015; Wangchuk et al., 2015; Wangchuk, He, Knibbs, Mazaheri, & Morawska, 2017). By charactering a range of air quality parameters, we have reported extremely high concentrations of particle mass and number concentrations during cooking using traditional biomass stoves, which highlighted severe household air pollution (HAP) problems. Authors have also reported ambient PM_{10} and $PM_{2.5}$ levels exceeding the World Health Organization (WHO) guidelines in a school outdoor environment. More studies are still needed to assess short- and long-term health outcomes associated with exposure to air pollution in rural areas. As a part of a larger study investigating air quality in different microenvironments in rural locations in Bhutan, this study performed measurements for particle mass and number concentrations in a representative rural outdoor location in eastern Bhutan. The primary objectives were to quantify and characterize typical concentrations of particle mass

& Cazzola, 2002; Pope III & Dockery, 2006; Tuckett, Holmes, & Harrison, 1998). The chemical composition of fine particles can range from soot to acid condensates, sulphates, nitrates and polycyclic aromatic hydrocarbons (PAHs) (Jantunen et al., 1999; Morawska & Zhang, 2002). UFPs are principally generated by combustion activities and atmospheric transformations of various precursors such as NO_x, SO_2, NH_3 and organic vapours, and typically contain metals, organic compounds, carbon, and acid aerosols (Westerdahl, Fruin, Sax, Fine, & Sioutas, 2005). While UFPs make only negligible contribution to particle mass, they constitute up to 90% of total particle number concentrations (PNC) (Morawska, Ristovski, Jayaratne, Keogh, & Ling, 2008).

(PM_{10} and $PM_{2.5}$) and particle number concentrations (PNC) in an outdoor rural environment. This is important given people spend time outdoors and since HAP can contribute to outdoor air pollution.

Methods

Study site - The air quality measurements were conducted in the Sherubtse College campus, Kanglung under Trashigang district. Sherubtse College occupies a central location within the Kanglung gewog. For the purpose of the larger Bhutan project described earlier, this site was used as a reference monitoring station. Prior to this study, the National Environment Commission (NEC) of Bhutan had used Sherubtse College campus to monitor ambient PM_{10} levels to assess rural air quality. Given these range of characteristics, the present monitoring site provides a good representation of ambient air quality for rural locations in eastern Bhutan. Instrumentation and quality assurance - PM_{10} and $PM_{2.5}$ were measured using two DustTraks aerosol photometer (TSI Model 8520, TSI Incorporated, St. Paul, MN, USA). DustTrak operates based on a light scattering technique where the amount of scattered light is proportional to the mass concentration of the aerosol. PNC was measured using a NanoTracer (NT), Philips Aerasense, Netherlands. The NT works by diffusion charging and has an upper resolution of 1×10^6 particles/cm^3 in the size range of 10 to 300 nm. A Q-Trak (IAQ-CALC Model 7545, TSI Incorporated, St. Paul, MN, USA) was used to measure temperature, relative humidity, CO and CO_2. This device has sensors to monitor different parameters: an electro-chemical sensor for CO, a thermistor for temperature, and a thin-film capacitive sensor for relative humidity. CO and CO_2 results are not reported in the present study.

All the instruments were tested and calibrated at the International Laboratory for Air Quality and Health, Queensland University of Technology, Brisbane, Australia. The measurements of PM_{10} and $PM_{2.5}$ obtained using the DustTrak are not actual gravimetric values, as the instrument was not calibrated for the aerosol studied. The measurements are therefore approximations, although relative differences between PM_{10} and $PM_{2.5}$ measurements are still captured. For simplicity, the DustTrak results discussed in this paper are referred to as PM_{10} and $PM_{2.5}$ (omitting the term 'approximation').

A correction factor for NT measurements of PNC was computed by running the instrument side-by-side with a condensation particle counter (CPC) TSI model 3787 as described by Mazaheri et al. (2014):

$$CF = C_{CPC}/C_{NT}$$

Where, C_{CPC} and C_{NT} refer to the concurrent total PNC measured by the CPC and the NT unit, and CF is the correction factor. It should be noted that CPC 3787 has a lower cutoff size of 5 nm in comparison to 10 nm for NT. Particles from 5 to 10 nm may account for an important fraction of the total PNC, in which case NT could underestimate PNC in the study site.

Sampling protocol - The outdoor air quality measurements were conducted between January 2012 and April 2013, which is a dry season in the study site, capturing winter and spring months in Bhutan. Winter months in the study site are characterized by cool, dry and occasional windy days, while spring months are characterized by warm and dry days. Air sampling was conducted from the first floor of the faculty office block using conducting tubes less than a meter to minimize particle loss and residence time.

All the instruments were set to a 10 seconds averaging interval. The DustTrak was zero calibrated and the flow rate checked prior to each sampling and maintained at 1.7 L/min. Instrument time stamps were synchronized with the local time. The Q-Trak probe assembly was extended outside the window, in the shade, in order to protect the sensors from the extreme weather. Sampling was done 24 hours a day and data from the instruments were downloaded

every two to three days.

Other data- The rainfall, wind direction and wind speed data were collected from the Kanglung weather station, located about 2 kilometres from the monitoring site, owned by the Department of the Hydromet Services. Only daily average data were available for these meteorological parameters.

Data processing and analysis

The data from the instruments were checked for anomalies and inconsistencies. PNC was corrected by accounting the NT correction factor described earlier. Some data was lost due to power outages over the course of the measurement period. In total, there were 19 days of full 24-hours PM_{10} data, 16 days of $PM_{2.5}$ data and 20 days of PNC data, available for analyses. Statistical analyses were performed using SPSS version 21 (SPSS Inc.). A 5% level of significance was used for all analyses ($p < 0.05$). A Spearman's rho correlation was used to analyse the correlation between pollutant concentrations. The pollution rose diagrams were plotted using the 'openair' R package (Carslaw & Ropkins, 2012).

Results and Discussion

Meteorological parameters

The mean ± standard deviation (s.d) for temperature, relative humidity and wind speed for the study site during the campaign were 11.3 ± 1.4 °C, 75.8 ± 9.9%, 1.76 ± 0.63 m/s, respectively. The total rainfall during the campaign was 48.4 mm, received towards the later part of the campaign, coinciding with spring days. These results represent typical meteorological conditions for the study site.

Particle mass and number concentrations

Figures 1 and 2 present the daily mean concentrations for particle mass (PM_{10} and $PM_{2.5}$) for the entire campaign. Results present a significant variability of daily mean concentrations, with most of the days presenting higher concentrations than the WHO 24-hour guidelines, i.e., 50 $\mu g/m^3$ for PM_{10} and 25 $\mu g/m^3$ $PM_{2.5}$ (WHO, 2006). The overall mean ± s.d was 71 ± 42 $\mu g/m^3$ for PM_{10} and 58 ± 32 $\mu g/m^3$ for $PM_{2.5}$, which was again higher than the WHO 24-hour guidelines. However, the daily mean PM_{10} concentration was within the range of Bhutan ambient air quality standard (NEC, 2010). Currently, there is no ambient standard for $PM_{2.5}$ in Bhutan.

The particle mass results were compared with the daily WHO guidelines given the very short campaign for this study. For campaigns with extended monitoring, comparisons should be made with annual guidelines (25 $\mu g/m^3$ for PM_{10} and 10 $\mu g/m^3$ for $PM_{2.5}$). For comparison, Figure 3 presents monthly mean PM_{10} concentrations from the monitoring done by NEC from the same site in 2011. During the dry season months (January to April and October to December), PM_{10} concentrations were order of magnitude higher than the WHO annual guideline. It should be noted that this study used the real-time instrument for measurement, while NEC used a high volume sampler, which is a gravimetric instrument. These findings are consistent with a previous study from a rural location in eastern Bhutan which also reported particle mass concentrations exceeding the WHO guidelines in wet and dry seasons, respectively (Wangchuk et al., 2015).

Figure 4 presents the daily mean PNC for the entire campaign, which ranged from 4.70×10^3 to 2.14×10^4 particles/cm^3. The overall mean PNC was $1.14 \times 10^4 \pm 5.46 \times 10^3$ particles/cm^3. At the time of this research, there were no similar studies in Bhutan that this result can be compared with. Globally, Morawska et al., (2008) conducted a meta study of PNC in different ambient environments, which reported concentrations (particles/cm^3) ranging from 2.61×10^3 for clean background to 1.08×10^4 for urban, and 4.21×10^4 for street canyon to 1.68×10^5 for tunnel environment, respectively. The PNC for this study was comparable with typical ambient

concentrations in urban areas. Currently, no threshold levels and international standards are available for PNC.

The analysis of hourly mean time-series concentrations for both particle mass and particle number presented moderate but distinct peaks during certain hours of the day (Figure 5). The peak concentration corresponded with the cooking time at the student mess, located ~200 m from the monitoring site. It should be noted that Sherubtse College where this monitoring was conducted is a residential College. At the time of this campaign, the student mess was operated centrally and cooking of meals for students was done using biomass stoves. This episode broadly confirms the influence of household air pollution to the outdoor air quality. Similar air pollution trend is expected in the villages since firewood is commonly used by many households for cooking.

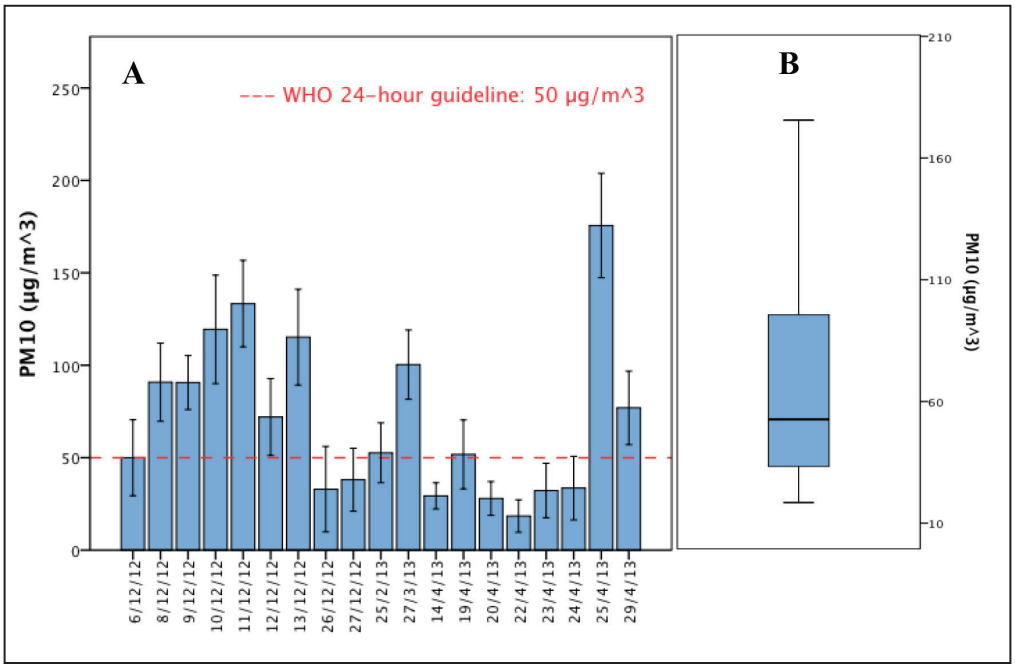


Figure 1: (A) Daily mean PM_{10} concentrations on measurement days. Error bars present standard deviation. (B) Distribution of daily mean concentrations showing minimum, first quartile, median (middle dark line), third quartile and maximum values.

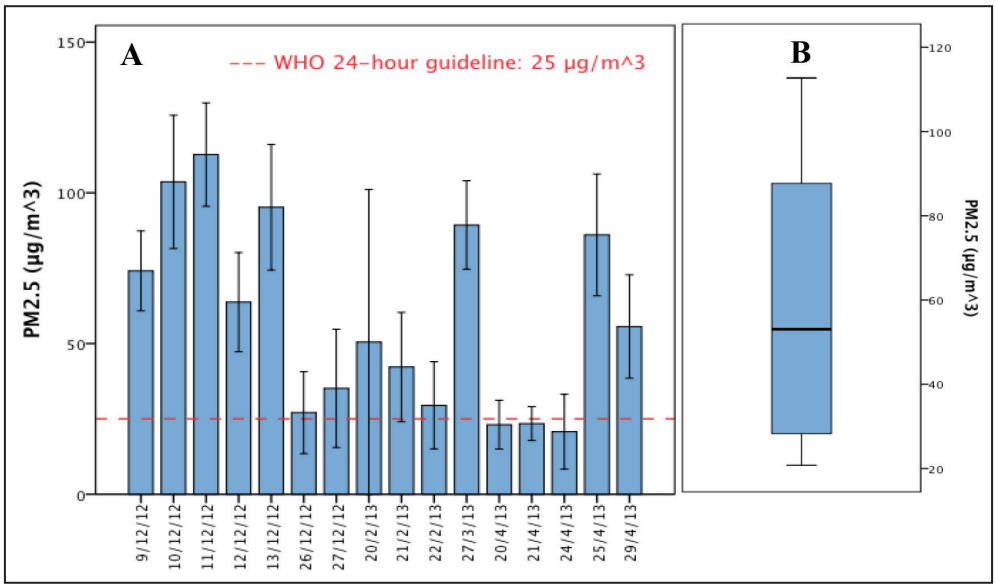


Figure 2: (A) Daily mean PM2.5 concentrations on measurement days. Error bars present standard deviation. (B) Distribution of daily mean concentrations showing minimum, first quartile, median (middle dark line), third quartile and maximum values.

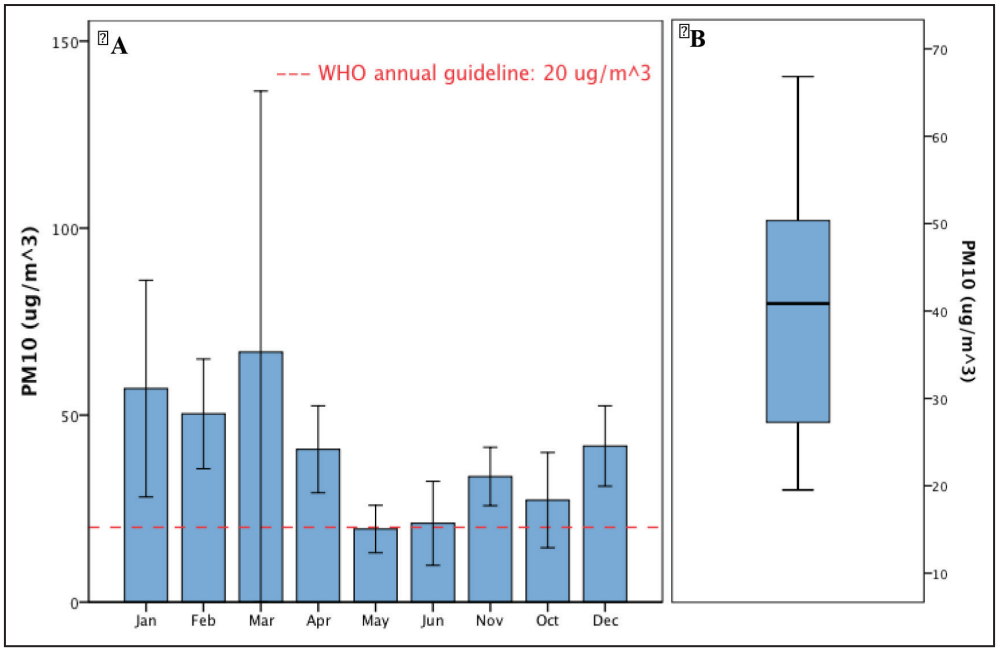


Figure 3: (A) Monthly mean PM10 concentrations. No data were available from July to September. Error bars present standard deviation. (B) Distribution of daily mean concentrations showing minimum, first quartile, median (middle dark line), third quartile and maximum values.

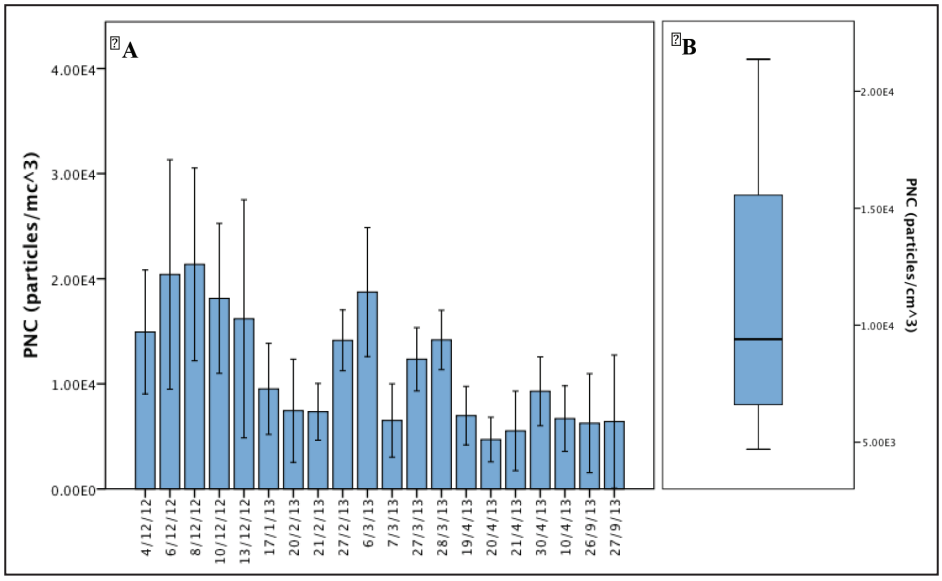


Figure 4: (A) Daily mean PNC on measurement days. Error bars present standard deviation. (B) Distribution of daily mean concentrations showing minimum, first quartile, median (middle dark line), third quartile and maximum values.

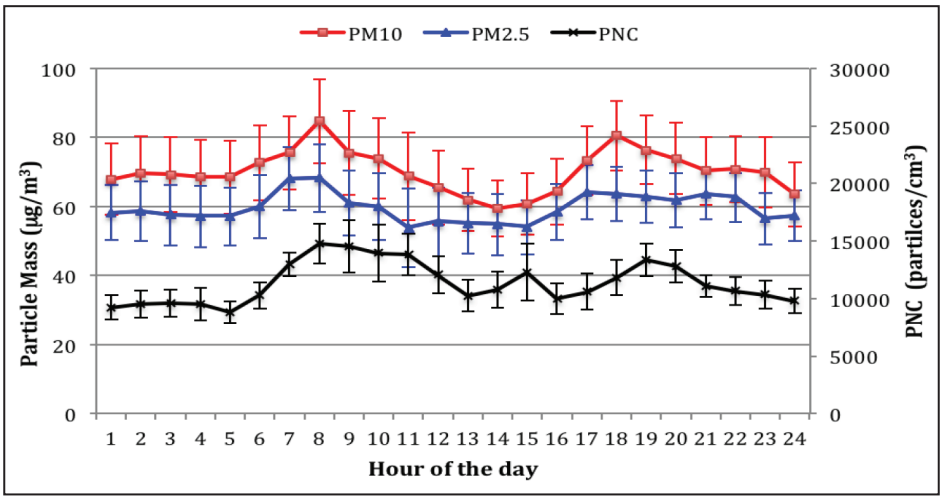


Figure 5: Mean hourly time-series concentrations of particle mass and number for the entire campaign. Error bars present standard error.

Correlations between pollutant concentrations and meteorological parameters

Figure 6 presents a bivariate correlation between pollutant concentrations for those days where data for all the pollutants were concurrently available. The highest correlation was observed for particle mass, between PM_{10} and $PM_{2.5}$ and low correlations between particle mass and PNC. This is not surprising given that particle mass and number have different source signatures, with particle mass generated primarily by mechanical activities (Jantunen et al., 1999; Pope III & Dockery, 2006), while particle number is chiefly emitted by combustion activities (Westerdahl et al., 2005). The corresponding Pearson (□) and Spearman (□) coefficients are presented in

Figure 5. □ is a parametric measurement, used when data are distributed normally, while □ is a nonparametric measurement, used when the distribution deviates from normality (Westerdahl et al., 2005). While both have been presented for comparison, □ is more relevant measure of correlation here since data are not normally distributed.

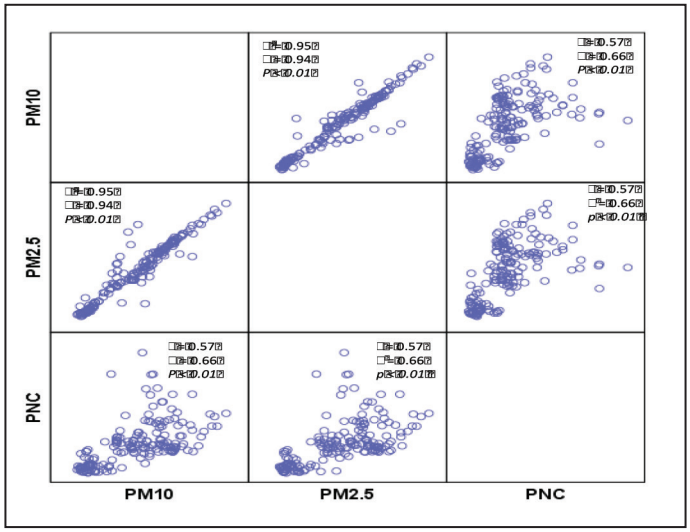
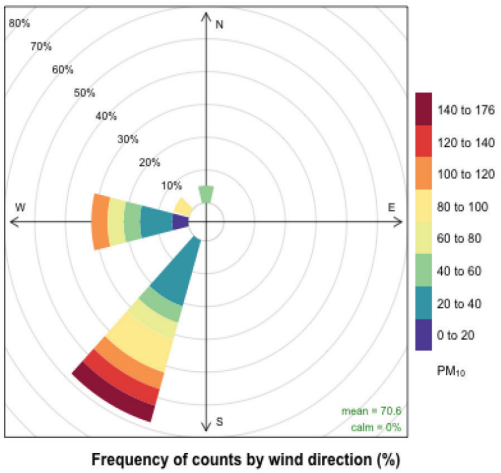
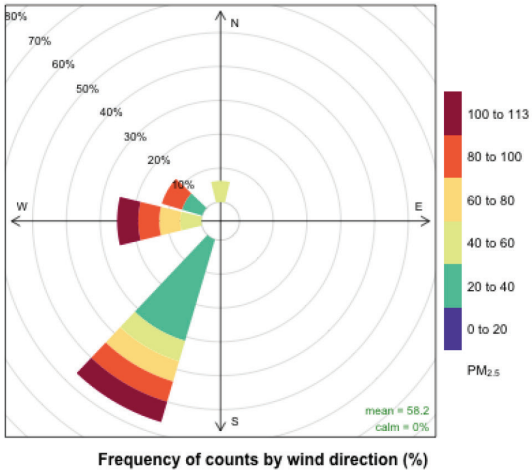


Figure 6: Correlation between pollutant concentrations

Figure 7 presents the association of particle concentrations with the wind direction in the study area. The highest pollutant concentrations for all particle size fractions were associated with the southwesterly wind. However, for PM2.5 and PNC a similar association was also observed with the westerly wind, indicating the presence of a combustion source in the upwind direction.





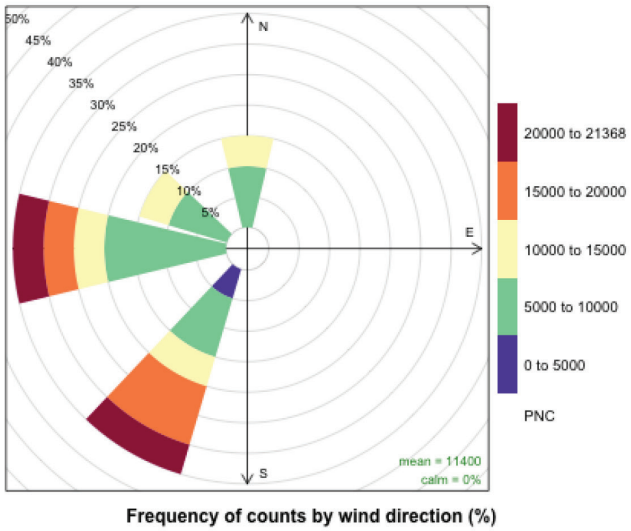


Figure 7: Pollution-rose diagrams for PM10, PM2.5 and PNC

Conclusion

As a part of a larger air quality investigation in Bhutan, this study characterized and quantified particle mass and number concentrations in a representative rural location in eastern Bhutan. Notwithstanding the short campaign, particle mass concentrations exceeding WHO guidelines have been observed. Even for particle number, concentrations higher than the global average for rural environments were observed. It is clearly evident that household air pollution resulting from the use of firewood for cooking influences outdoor air quality in rural areas. The findings of the study highlight significant air quality problems in rural areas, indicating that people were potentially exposed to high concentrations of particulate matter. However, conclusions for the present study were drawn from limited data from a short dry season campaign. Future studies should focus on longer-term monitoring covering seasonal influence to provide a more representative finding of air quality in rural locations.

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About the Author

Tenzin Wangchuk is a lecturer in Environmental Science and the current Dean of Aacademic Affairs at Sherubtse College. He has a Master of Environment from the University of Melbourne, Victoria, Australia; and a PhD from the Queensland University of Technology, Brisbane, Australia. His research involves area and exposure monitoring of household air pollution in rural areas.

Quantitative Study on Teachers' Core Competency Level of Phuentsholing Thromde Schools

Dorji Tshering

Abstract

The purpose of this study was to examine the teachers' core competency level of Phuentsholing Thromde Schools. The total of 79teachers was selected for the study. It comprises of 27 males and 52 female teachers. The study was done through survey questionnaires, comprised of six categories of core competencies (Punctuality, Commitment, Relationship, Teamwork, Communication skills and leadership) containing 33 items which were distributed to the teachers in the schools. The data was analysed using SPSS program package.

Findings revealed that core competency practised by teachers of Phuentsholing Thromde Schools was at high level. Punctuality, Leadership and Commitment were at highest level whereas Communication skills were at moderate level. Test results showed that gender has no effect on teacher core competency.

The key to promoting teacher core competency is to enhance consistent support and motivate teachers. Then only teachers will remain in the same profession. It is hoped that findings will help Ministry of Education, Dzongkhag education office and Thromde education office to understand the core competency level of teachers and provide necessary support to the teachers to remain in the teaching profession.

Key Words: *Competency, Punctuality, Commitment, relationship, Teamwork and leadership*

The formal education system of Bhutan has been promoted and expanded since first five-year plan 1961 to address the basic educational needs and develop human resources required for the socio-economic development of the country. At the same time, the expansion of education system has been accompanied by a rapid growth in enrollment of students as a Royal Government's commitment to education. In order to improve the quality of education of education in Bhutan, the new paradigm of change was introduced in leadership and management approach in 2010. The transition of principal's roles from administrators and managers to instructional leaders was one of the ten charters under the compact agreement signed by the Ministry of Education with Royal Government of Bhutan (EMSSD, 2010). In order to establish the desired standard of behaviour amongst the civil servant and to recognise for the civil servant to be dynamic, independent and apolitical the Position Classification System (PCS) policy was introduced in January 2006 (RCSC, 2006). Subsequently, Teacher Human Resource Policy (2014) was promulgated to attract and retain the best and the brightest into the teaching profession.

According to Royal Civil Service Commission (2012), core competency is the special skills or qualities required to fulfil the role and responsibilities of the position. From the education point of view, it is the quality of care and education services which impact children's academic and social outcomes (Ceglowski, 2004). The study done by Michelle, Daryl, & Rebecca (2011) revealed that honesty, positive attitude, and being a teamwork were the most important job skills confessed by employers, while parents supported that attendance, honesty, positive attitude and self-confidence were very important. Educators, however, rated attendance as the number one skill necessary for successful employment followed by punctuality. As per the Department of Education Training, Western Australia (2004), it describes professional standards for teaching and makes the knowledge and capabilities of teachers explicit for those within and outside the profession. They provide the means by which good teaching can be identified, rewarded and celebrated. Furthermore, it has been argued that it is a valuable tool for increasing public confidence in the school education system.

Royal Civil Service Commission Individual Work Plan report (2015) confirmed that the average rating of civil servant performance was 3.83which was found to be exceptionally outstanding (see Table1). Teachers which constitute more than 37.73 % (Civil Service Statistics December 2015) of total civil service strength are consistently blamed for poor curriculum delivery and quality of education. A study done by Wangmo, Subba, Tandin, Jurme and Yangdon (2015) found out that providing a quality education to the students have become a major concern to the teachers. Royal Educational Council report (2009) affirmed that workload and poor pay has unable to attract the brightest teacher candidates. Pressing demand for teachers has created a system that accepts any candidates regardless of merit and ultimately employs all graduates. Many teachers feel that teaching was their last option. The study conducted by Royal Education Council (2010) again confirmed that only a handful of students' opted to teach out of genuine interest. Many students confessed that they will stay in teaching for few years. Furthermore, it was found out that a substantial number of teachers leave their profession every year. According to the Kuensel report (2015), an average number of 228teachers had left the teaching profession every year in the last five years.

Despite numerous international study carried out on teacher core competencies, there is no study conducted in the Bhutanese context to understand the perception of teacher core competencies.

The present study was undertaken to study teachers' core competency level for teachers' under Phuentsholing Thromde. This study was done in Phuentsholing, under Chukha Dzongkhag in Bhutan, situated at an altitude of 293m above sea level, which borders Indian state, West Bengal. Phuentsholing has a population of 20,537 (Population and Housing Census of Bhutan, 2005). It is one of the business hubs for the people of Bhutan as well as the people living nearby the border areas. People from all walks of life are settled in this town which provides a diversity of social and cultural life. Thus, to educate children living in this place, four public schools have been established; Phuentsholing LSS, Sonamgang MSS, Phuentsholing MSS and Phuentsholing HSS.

This study is deemed very significant because the findings determined the level of core competencies of teachers working in the schools. The core competencies of teachers, in fact, determine the quality of service provided in the schools. Moreover, this is the first study done in our country to actually study the core competency of teachers. Hence, the findings from this study play a significant role in shaping civil service human resource development policies, education policies, and even help managers to provide necessary professional support based on the need to strengthen the quality of education.

Table 1.1: The summative review form to the head of agency for review and final approval

Outstanding	represented a mean 3.50 – 4.00
Very Good	represented a mean 2.50 - 3.49
Good	represented a mean 1.50 – 2.49
Improvement needed	represented a mean 0.00 – 1.49

Source: Royal Civil Service Commission (2012)

Objective of the study

The objectives of this study are to determine the level of teacher core competency in Phuentsholing Thromde Schools and how it differs according to their gender.

Research Question

1. What is the core competency level of Phuentsholing Thromde Schools Teachers?
2. Do teacher core competencies differ according to their gender?

Literature Review

Royal Civil Service Commission (RCSC) was established in the year 1982 by His Majesty the Fourth Druk Gyalpo through a Royal Charter (RCSC, 2012). Under a democratic Bhutan with the adoption of the Constitution of the Kingdom of Bhutan, RCSC is one of the four Constitutional Offices of Bhutan. In order to establish the desired standard of behaviour amongst the civil servant and to recognise for the civil servant to be dynamic, independent and apolitical the Position Classification System (PCS) policy was introduced in January 2006 (RCSC, 2006). The Performance Management System of Bhutan Civil Service Rules and Regulations (2012) states that Performance Appraisal System (PAS) was introduced to enhance employee performance, provide incentives, rewards and manage poor performers.

PAS consisted of two appraisal instruments, Executive Performance Appraisal and General Civil Servants Appraisal. The performances of the Executives are completed by the manager of the executive. The performance of the Secretary of the Government is appraised by RCSC in consultation with the minister concerned (RCSC, 2012).

There are two parts in the appraisal process for general civil servants. The part I cover Work Planning and Review Form. This form is used by manager and employee to determine half-yearly target and identify six relevant core competencies. The manager and the employees jointly identify six core competencies relevant to the employee's position. The three core competencies Integrity, Attitude and Punctuality are fixed and have to be practised by all civil servants. Rest of three core competencies are identified by the employee and manager (RCSC, 2012)

Part II is about Summative Performance Review Form. It is used by the head of the organisation, the manager and the employee to reflect on the work targets and the overall performance of the employee (RCSC, 2012).

According to Teacher Human Resource Policy (2014) teacher can identify core competencies relevant to his or her performance output jointly with the Principal in addition to the three core competencies fixed by RCSC. Minimum of two classroom teaching should be observed by Principal to evaluate teacher's core competencies.

Teacher's annual performance rating will be based on the performance Outputs and Core Competencies. Teacher and Principal should discuss the ratings and agree on them. The principal will provide final ratings for the Core Competencies. The weightage of 40% is given to the Core Competencies during the final performance evaluation of teachers (Teacher Human Resource Policy, 2014)

What is Core Competency?

This section presents the definition and concept of core competency. According to González and Wagenaar (2005), it is something that can be demonstrated to a certain level of accomplishment along with a continuum. However, Rychen and Salganik (2008) argued that it is the complex action system incorporating knowledge, cognitive and practical skills; attitudes such as motivation, value orientations, emotions. Further, it was also stated as the combination of knowledge, skills, attitudes, values and personal characteristics, empowering the teacher to act professionally and appropriately in a situation, deploying them clearly. Caena (2011) said a teacher competence refers to a wider view of teacher professionalism. It considers the multifaceted roles of the individual, of the school, of the local community, of professional networks.

Therefore, core competency is the skills and values required by every individual to achieve their role and responsibilities for their professional achievement and success. In this study teacher, core competency was measured with six variables. They are punctuality, communication skills, relationship, teamwork, leadership and commitment.

Punctuality

According to Cabral and Almeida, (2006) it is something that completes or reaches on time. During Anglo's time, money and punctuality were priceless. Jones and Brown (2005) study found out that colour people time is used by African Americans to refer to a casual attitude toward the value of time. Similarly, Alves (1997) also described the rubber time used by Indonesians to tease to their laidback attitude about appointments, schedules and deadlines Levine et al. (1980) found that Americans were more punctual than Brazilians, and Brazilians were more flexible than Americans in terms of time and dateline. White, Valk, &Dialmy(2011) study revealed that "Punctuality appear to be best understood within a situational and sociocultural—rather than dispositional—framework

However, in this study, punctuality refers to teacher daily attendance and regularity in general activities such as morning SUPW, assembly, class, meditation, evening prayer. It further extends other regularity such as while conducting co-curricular and extra-curricular activities within and outside of school premises.

Communication Skills

Loss (2000) said it is a skill of utilising positive statements, rather than accusatory statements. Erozkan (2013) argues that communication skills is an important interpersonal competency, it involves the ability to engage effectively in complex interpersonal interaction and to use and understand people effectively. Ihmeideh, AL-OMARI, & Al-Dababneh (2010) expressed communication skills are required by teachers to facilitate understanding of teaching findings and the ability to accomplish their responsibilities effectively. Teachers must possess highly developed communication skill levels to become a successful professional. Scudder and Guinan (1989) study found correlations between employees' communication skills and supervisors' perception of job performance.

Consequently, communication skills refer to teacher competence in overcoming complex interpersonal relationship interaction effectively without hurting each other. It also includes body gesture, facial expression and tone used in the course of intimidation.

Relationship

Ihmeide, Al-Omari & Al-Dababneh (2010) defined the relationship is an ability to work on teams, teach others, serve customers, lead, negotiate, and work well with people from culturally diver backgrounds. The American Secretary's Commission on Achieving Necessary Skills report (SCANS, 1992) identified relationship skills as one of the essential competencies necessary for success in the workplace. Bulut and Usta (2007) said interpersonal relationship problems arise when messages on either end are misunderstood. As per Unal (2012) findings, positive "management-student", teacher-student" and "school-environment- student" relationship have positive influences on quality of education and students' academic success.

Therefore, it is understood as a cordial relationship amongst managements, colleagues, students and parents by creating positive working atmosphere.

Teamwork

Murphrey, Harlin and Rayfield (2011) coined, teamwork is a sustainable cooperation and group effort over time, with a common purpose for the benefit of both agencies, key stakeholders, and

the community

Wood and Gray (1991) supported that when a group of stakeholders engage in an interactive process, using shared rules, norms, and structures, to act or decide and supported that issues related to that domain are teamwork. Mattessich and Monsey (1992) argued that it is "a mutually beneficial and well–defined relationship entered into by two or more organisations to achieve common goals".

Elbousty and Bratt (2010) said teamwork helps teachers to gain classroom management, motivation and learning disabilities. Additionally, it was stated that working together collectively solved problems, saved time and benefits from constructive criticism. It was also declared that strong group efficacy leads to the acquisition of new skills and the production of new knowledge.

Teamwork means the willingness to work together and forwardness of the individual to cooperate in any decision-making process. Teachers have to work collaboratively throughout the school to bring change in school performance. At the beginning of the academic session, committees are formed to execute their role and responsibilities. These can be achieved only if they work together with a great working atmosphere of togetherness.

Leadership

According to Xu and Patmor (2012), teacher leadership is about empowering teachers to take a more active role in school improvement. Childs-Bowen, Moller and Scrivner (2000) defined teachers are leaders when they function in professional learning communities to affect student learning; contribute to school improvement; inspire excellence in practice, and empower stakeholders to participate in education. Xu and Patmor (2012) also learn that Kentucky Education Professional Standards Board (EPSB) had identified four criteria for defining teacher leadership, namely, the level of a teacher's performance in identifying leadership opportunities that enhance student learning and/or professional environment of the school, the level of a teacher's performance in developing a plan for engaging in leadership activities, the level of a teacher's performance in implementing the plan for engaging in leadership activities and the level of a teacher's performance in analyzing data to evaluate the results of planned and executed leadership efforts. According to Task Force on Teacher Leadership (2001) teacher leader concept is not about training teachers to become school administrators, but empowering teachers to take a more active role in school improvement.

In this study, teacher leadership is all about teacher forwardness in executing any task for the betterment of the students. An exemplary role model demonstrated by teacher professional development, student learning and practice excellence in teaching.

Commitment

Commitment is understood as appearances of behaving as a professional. But Firestone and Pennell(2011) uphold that commitment "is an identification of an individual with an object that takes on a special meaning and importance"

Mkumbo (2012) revealed that teachers' commitment to the teaching profession is devastatingly low, with the majority of teachers expressing that they did not choose the teaching profession as their choice, but were compelled by the easiness to get the job and lack of qualifications to join other professions of their liking and choice

In conclusion, commitment refers to teacher positive attitude towards teaching profession. It also includes commitment towards other job responsibilities such as a class teacher, housemaster and club coordinator.

Method

This study was carried out by using descriptive survey method. Data is presented to examine the level of teacher core competency of Phuentsholing Thromde Schools and how these core competencies differ according to gender.

Population and Sample of study

Participants were sampled by convenience sampling method due to the limited resources and time constraint. This technique was used due to convenient for the researcher to collect data as the schools are in the vicinity of the researcher's working place. Due to its proximity, the collection of data from three different schools was convenient and appropriate. This method can be applied when sample units are selected from easily accessible due to the existing limitations of the money, time and workforce (Büyüköztürk, KılıçÇakmak, Akgün, Karadeniz &Demirel, 2011). The study was conducted with 79 teachers of Phuentsholing Thromde schools. It consists of 27 male and 52 female teachers. The principals of the selected schools were informed beforehand and sought approval for the conduct of the study. The intent of conducting the study was informed verbally as well as in written form. The survey questionnaires were handed over to one of the teachers appointed as a focal teacher for the distribution and collection of questionnaires. Duration of two days was given to collect all the questionnaires from the participants. After two days, questionnaires were collected from the focal teacher by the researcher. Out of 129 survey questionnaires distributed, only 79 questionnaires were collected back. The overall response was 61.24 %.

Table 3.1: Total number of teachers in each school, Phuentsholing Thromde

School	Male	Female
Phuentsholing HSS	23	23
Phuentsholing MSS	14	24
Phuentsholing LSS	7	38
Total	**44**	**85**

Source: School Profile for schools under PhuentsholingThromde, 2015

Instrumentation

A questionnaire was divided into two parts. Part I was used to obtaining the participation background information. The second part of the questionnaire consist of 33 items divided into six categories to measure core competencies (Punctuality -5 items, Commitment – 6 items, Relationship – 4 items, Teamwork – 5 items, Communication skills – 5 items and leadership – 8 items).All these questionnaires were adopted with slight modification to fit Bhutanese context. However, punctuality and teamwork variables were made through reviewing other competency documents and best practices in teacher preparation.

Table 3.2: Sources of variables in this study

Variable	Scale	Researcher(s)
Commitment	Teacher Job Performance (TJB)	Wang (2010)
Relationship	Teacher Job Performance(TJB)	Wang (2010)
Leadership	Teacher leadership Readiness	Sack (2004) (Sacks, 2004)
Communication skills	Communication Skills Attitudes Scale (CSAS)	Rees, Sheard, & Davies (2002).

Scale responses were made on a 5-point Likert scale *1 (Strongly Disagree), 2(Disagree), 3 (No Opinion), 4(Agree) and 5 (Strongly Agree)*

The data was analysed by using SPSS package program. Frequency, mean, standard deviation and percentage were used to understand participant's background. Independent Samples t - test was used to examine how the gender affects the teacher core competency.

Result

Validity and reliability of scales

The content validity of the questionnaire was assessed individually by three experts in the field of educational technology. A pilot study was conducted to the test the reliability of the instrument in one of the middle secondary schools in Phuentsholing Thromde. The total of 35 teachers was selected randomly to response the survey questionnaires. The researcher was also one of the participants in the pilot test school. Cronbach's alpha coefficient (1920) was employed to assess the reliability of the instrument and value was computed using statistical analysis. Cronbach's reliability analysis was performed to test the internal consistency of the variables. The reliability of all the working factors was found between .63 to .82 as summarised below.

Table 4.1: Summary of reliability check of individual working factors

Variable	Punctuality	Commitment	Leadership	Relationship	Communication skills	Teamwork
□	.82	.77	.79	.68	.63	.64

Demographics of participants

Table 5 presents the general characteristics of the sample. The sample was largely comprised of female teachers (65.4 %). The result shows that 48.2% of the teachers were between the ages 31 – 40 years and more than two - third of the teachers (85%) were married. Almost half of the teachers (49.4 %) have Bachelor Degree (B.Ed) in education. Finding also indicated that more than half of the samples (51.2%) have a teaching experience more than 16 years.

Table 4.2: Frequency and Percentage of Demographic Characteristics of the Sample

Variables	Frequency	Percentage
Gender		
• Male	27	34.6
• Female	51	65.4
Age (Years)		
• 21 – 30	6	7.2
• 31 – 40	40	48.2
• 41 – 50	25	30.1
• 51 – 60	12	14.5
Marital Status		
• Single	10	12
• Married	71	85.
• Others	2	2.5
Level of Education		
• PTC	14	16.9
• B.Ed	41	49.4
• PGCD	10	12
• Master	18	21.7
Teaching Experience		
• 1 – 5 years	4	4.8
• 6 – 10 years	19	22.6
• 11 – 15 years	18	21.4
• More than 16 years	43	51.2

Descriptive statistics of level of teacher core competencies

The finding presented in (Table 6) informs descriptive statistics of six observed variables. The researcher has assigned criteria for understanding the mean score into five levels based on Best's Criteria (1977).The four categories adopted by the RCSC (2012) could not be used for understanding the core competencies of the teachers because the scale responses were made on a 5-point Likert scale and do not represent a mean of 0 -1.49 (Improvement Needed category adopted by RCSC, 2012).

Lowest level	represented a mean of 1.00 – 1.80
Low level	represented a mean of 1.81 -2.60
Moderate level	represented a mean of 2.61 – 3.40
High level	represented a mean of 3.41 – 4.20
Highest level	represented a mean of 4.21 – 5.00

It can be concluded that the overall opinion about the core competency elements of the civil service teachers was at a high level whereas punctuality, leadership and commitment were at the highest level (M=4.62, M= 4.22, M= 4.46) respectively. But communication skill was found at the moderate level (M = 3.12).

Table 4.3: Opinions about the core competency elements of the civil service teachers under the Phuentsholing Thromde School

	Mean	Std. Deviation	Level
Com_Skill	3.12	.78	**Moderate**
Commitment	4.46	.38	**Highest**
Relationship	4.08	.57	**High**
Team_W	4.20	.43	**High**
Punc	4.62	.41	**Highest**
Leadership	4.22	.43	**Highest**
Core Competency	**4.12**	**0.50**	**High**

Effect of Teacher Core Competencies by Gender

An independent samples t-test was conducted to determine teacher core competency according to their gender. The results from Levene's Test for homogeneity of variance across the males and females groups for each variable indicated that homogeneity of variance was met for all the six variables. As p> 0.05 for all variables, Levene's Test shows that the groups were homogenous as shown in (Table 7).

The result indicated that there was no significant difference in teacher core competencies between the two groups (p > .05). Accordingly, it can be said that gender doesn't affect core competency. Therefore, gender doesn't have significant effect on teacher core competency

Table 4.4: Independent sample t-test result of Teacher Core Competencies According to Gender

	Gender	N	Mean	SD	Levene's Test for Equality of Variances		t-Value	df	Sig. (2-tailed)
					F	**Sig.**			
Com_Skill	Male	24	3.22	.72	.120	.731	.568	71	.57
	Female	49	3.10	.8					
Commitment	Male	25	4.47	.417	1.70	.196	.210	73	.84
	Female	50	4.45	.38					
Relationship	Male	26	4.09	.55	.26	.611	.010	71	.99
	Female	47	4.09	.57					
Teamwork	Male	27	4.20	.43	.04	.846	-.160	74	.87
	Female	49	4.22	.42					
Punctuality	Male	25	4.58	.44	1.09	.300	-.589	74	.56
	Female	51	4.64	.40					
Leadership	Male	25	4.21	.44	.129	.720	-.117	69	.91
	Female	46	4.22	.44					

Discussion

The civil service teachers under Phuentsholing Thromde revealed the opinion on the elements of core competency at a high level. This finding corroborates the Royal Service Commission Report on civil service performance rating which was found high level 3.8. According to the findings, civil service teachers paid more attention to punctuality which scores the highest level. This may be because punctuality is made mandatory core competency for all the civil servant of Bhutan (RCSC, 2012). This could be also because they need to complete their teaching as per the prescribed syllabuses within the given stipulated time. It is a time bound duty. Teachers have to be a role model to inculcate good values in service delivery and punctuality. Result also revealed that leadership and commitment were also equally high. This may be because teachers have to be always a leader first to lead our innocent children who come to school every day to learn from them since teaching is considered to be a noble profession one has to be totally committed to their profession. Moreover, it is also mandatory core competency required by the civil servant (RCSC, 2012). The finding supports the study conducted by Namgay and Yuden (2013) that 85% of the teachers' belief on the nobility of the teaching profession.

The communication skills competency revealed the lowest opinion score. This probably could be because teachers are engaged every time in classroom teaching and hardly interact with the other stake holders.

Independent Sample t-test confirmed that gender has no effect on teacher core competency even though urban schools have female dominating teachers. This is probably because a minimum of seven core competencies has to be practised by all civil servants irrespective of gender according to Royal Civil Service Commission (2012).

Suggestions

The following are the few suggestions for the improvement of teacher core competencies

1. The core competency of teachers under Phuentsholing Thromde is found to be at high level. Therefore, the researcher felt the urgency of consistent support from the Ministry of Education and related agencies like Dzongkhag/Thromde education sector to motivate teachers to retain them in the same profession.
2. The researcher also like to put forth to the Dzongkhag/Thromde education sector to develop a policy, strategies and projects for more effective and efficient performance of civil service teachers and education personals.
3. This study was limited to Phuentsholing Thromde schools and therefore similar type of future study could be carried out to examine and compare core competencies of civil service teachers, administrators and education personals from different schools with various size, location, school and type (Best Practice schools & ordinary schools) for a better result.

Conclusion

This study investigated the level of teacher core competency of Phuentsholing Thromde Schools and how these core competencies differ according to gender. The data gathered from survey design were analyzed using descriptive statics and independent t-test. Findings revealed that core competency practised by teachers of Phuentsholing Thromde Schools was at high level. Punctuality, Leadership and Commitment were at highest level whereas Communication skills were at moderate level. Test results showed that gender has no effect on teacher core competency. Therefore, consistent support from the Ministry of Education and related agencies like Dzongkhag/Thromde education sector is required to motivate teachers to retain them in the same profession.

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About the Author

Dorji Tshering, Principal of Sonamgang Middle Secondary School, Phuentsholing Thromde since 2014, holds a Bachelor of Education (Secondary) from National Institute of Education, Samtse (2002). He worked as a teacher for six years and Vice-Principal at Daga Middle Secondary School. In 2008, he got promoted to the Principal of Nganglam Middle Secondary School and served there for 4 years. In 2013, he completed his Master's Degree in Educational Management (M.Ed) from Mahidol University, Thailand in 2013. His research interests are leadership and management in education.

EXPLORING BULLYING AMONG STUDENTS OF GESARLING MIDDLE SECONDARY SCHOOL, BHUTAN

Yeshi Nidup

Abstract

There is an abundance of literature on bullying, however, there is only a few conducted in Bhutanese context. This quantitative study is aimed at exploring the prevalence of bullying among students of Gesarling Middle Secondary School in Dagana district in Bhutan. The study is also intended to determine the level of different forms of bullying, namely, verbal, social and physical bullying in the school. 242 students from classes I to IX (age ranging from 7 to 16 years) were chosen as sample using random sampling technique. The data was obtained using a survey questionnaire. The data was analyzed using Microsoft Excel to calculate percentages and averages for each form of bullying. The results of the analysis showed that the overall level of bullying in the school was low; however, the analysis of the three forms of bullying showed that there were certain elements that were high. In verbal bullying, teasing, calling nicknames and making annoying remarks were slightly high. Neglecting by friends and spreading rumours were high in social bullying. With regard to physical bullying pinching, pushing and pulling were high. So to bring down bullying in school, recommendations were made to the school leaders, teachers and students to improve the school's learning environment.

Key Words: *bullying, verbal bullying, social bullying, physical bullying, secondary School, Bhutan*

Introduction

In education, school environment has a strong influence on students' learning. The environment in the school is determined by many factors such as teachers, friends, resources, rules and regulations. For students, friends are the closest persons with whom they interact most in school, next to teachers. Social learning theorists such as Vygotsky (1978) and Bandura (1977) stated that learning to a great extent occurs in a social context and the social climate created by their friend's behaviour has a strong bearing on children's learning. They stated that children learn by interacting with friends and teachers. This implies that schools as social contexts for student learning need to be conducive, supportive and free of threats (Ancho & Park, 1998). A good social climate provides an enabling condition for children to learn while an insecure and unsafe climate hinders effective learning.

Bullying in school is an issue across the world. Studies by Shellard & Turner (2004) and Lumsden (2002) have found that bullying by friends in school has a negative effect on children's learning due to the creation of an intimidating environment. Bullying results in children dropping school, disliking schools and poor academic performance (Nansel, Overpeck, Pilla, Ruan, Simon, Scheidt, 2001). It has been also learned that victim of bullying become less engaged in school, their grades and test scores decline (Cornell, Gregory, Huang, & Fan, 2013). Moreover, Craig, Peters and Konarski (1998) has shown that children who are victims of bullying are at risk of developing problems such as criminality, unemployment, depression, anxiety, and reduced attainment and competence in adulthood. Longitudinal research indicated that childhood bullying is associated with adult antisocial behaviour and limit opportunities to attain socially desired objectives (Farrington, 1993). Besides, victimized children are more anxious and insecure (Olweus, 1991); have lower self-esteem and are depressed (Craig et al, 1998), is lonely and more likely to be rejected by their peers than non-victimized children (Boulton & Underwood, 1992).

The study has also found that bullied students experience higher rates of anxiety,

depression, physical health problems, and social adjustment problems that can persist into adulthood (Carlisle & Rofes, 2007). In addition, bullying and victimization and their associated behaviour problems are not only chronic but are often transmitted across generations (Farrington, 1993). Copeland and Piazza (2008) have also demonstrated that being involved as both a perpetrator and victim experiences worse outcomes than either bullies or victims, being at greater risk for anxiety, depression, low self-esteem, self harm, suicidal ideation, physical injury, substance abuse, negative attitudes toward school, absenteeism, poor perceptions of school safety, aggression, and delinquency. Also, being bullied by peers (victimization) has been linked with poor physical health (Gini & Pozzoli, 2013) and poor school adjustment, including being unhappy, feeling unsafe, being truant, performing poorly and, in some cases, dropping out of school (Graham, Bellmore, & Juvonen, 2007; Slee & Rigby,1993). Bolaños, Ingram, Barrera, Greer, Hantman, Karp, Logan, Pérez, Stinson, Crew (2005) have also found victims having difficulty concentrating on their schoolwork and decline in academic performance. Besides, victims tend to have a higher rate of absenteeism and dropout rates and may show signs of loneliness; they have trouble making social and emotional adjustments, difficulty making friends, and poor relationships with classmates. They often suffer humiliation, insecurity, and loss of self-esteem and may develop a fear of going to school. Bullying behaviour has also been linked to other forms of antisocial behaviour, such as vandalism, shoplifting, skipping out of school, fighting, and drug and alcohol use (Office of Juvenile Justice and Delinquency Prevention, 2001). As adults, bullies have increased rates of substance abuse, domestic violence, and other violent crime (Ballard, Argus, & Remley, 1999). Rigby (2003) identified and categorized the possible consequences and negative health conditions of those involved in bullying as low psychological well-being, poor social adjustment, psychological distress and physical unwellness.

Bhutanese education policies are in accordance with Article 28 (Right to education), Child Right Convention (UN Convention, 2013), which states that all children have the right to a primary education and for children to benefit from education, schools must be run in an orderly way – without the use of violence providing education in a safe and secure school environment. Also, Article 9, section 17 of the Constitution of Bhutan (The Constitution of the Kingdom of Bhutan, 2009) enshrines that the state shall endeavour to take appropriate measures to eliminate all forms of discrimination, abuse, violence, harassment and intimidation in all spheres. Royal Education Council ([REC], 2012) mentioned that schools should provide the conditions for achieving the quality standards that Bhutan envisions for its children by creating a child-friendly school. Similarly, Educating for Gross National Happiness (GNH, 2013), at the end a new education paradigm in Bhutan also advocates safe and secure learning environment in school. Also, Bhutan Education Blue Print, 2014 – 2024 (Ministry of Education, 2014) has a strong emphasis on school safety and safe school environment. It specifically mentions that

> Students deserve all forms of safety and security while at school and most of all students need caring adults who create an atmosphere of sincere support for their well being and academic success. All children should feel safe from physical harm for living, learning and work in the school. A healthy school environment can directly improve children's health and effective learning and thereby contribute to the development of healthy adults as skilled and productive members of society (p. 44).

In Bhutan, quality education has become an issue. Small and trivial it may be, yet a crucial factor such as bullying could have a significant bearing on the quality of education. With the launch of education for GNH, schools are committed to promoting emotionally and psychologically safe and secure learning environment. The first prime minister of Bhutan, Jigme Y. Thinley said,

Bringing GNH into the schools over the time, suffuse their atmosphere with such joy and mutual sense of purpose that students will eagerly look forward to each day they spend together. GNH inspired school ambience and activities cannot help but lighten what we currently

experience as burden (Educating for GNH, 2013, p. XI).

Therefore, when the country is in pursuit of determining some of the factors attributing to the quality of education, it is relevant to bring bullying a phenomenon that seems to be a commonplace and often regarded as trivial in schools, into the light. Not much research has been done in Bhutan to determine bullying in schools. However, the bully-victim behaviour is reported to be rampant in schools, contributing to students feeling unsafe which in turn undermines their ability to learn and develop in healthy ways as mentioned in education blue print, (Ministry of Education, 2014). However, a National Survey on Violence Against Children and Young People in Bhutan conducted by National Commission for Woman and Children [NCWC], (Thompstone, 2016). The findings from this study have given researchers to put this study into the Bhutanese context. Considering the social element of a child's learning environment as an important factor that influences learning.

Research purpose

The purpose of this quantitative survey research is to determine the prevalence of bullying among students of Gesarling Middle Secondary School (GMSS) under Dagana Dzongkhag in Bhutan. If prevalent, the study is also aimed to determine the level and delineate the most common forms of bullying.

Research question

1. Is bullying prevalent at Gesarling Middle Secondary School, under Dagana Dzongkhag?
2. Which forms of bullying is most dominant in the school?
3. How frequent are each form of bullying in the school?

Significance of the study

In view of ensuring safe and secure social environment in school, the findings of the study would help determine the level of bullying and the dominant form of bullying in Gesarling MSS. It would also help the school leaders, teachers and parents to identify measures to prevent bullying if it existed. The effort would help to create a safe and secure environment to facilitate effective learning.

Definition of terms

Bullying: Any aggressive/negative intentional acts directed (by one or more individuals) toward victims in order to cause physical, verbal, psychological, or social harm or hurt (Olweus, 1993)
Physical bullying: hitting, kicking, tripping, pinching, and pushing or damaging the property of another student
Verbal bullying: name-calling, insulting, teasing, intimidating, making homophobic or racist remarks, or verbally abusing another student
Psychological or social bullying: designed to harm another persons' social reputation and / or cause this person humiliation, including lying and spreading rumours, hurtfully mimicking behaviour, playing nasty jokes designed to cause embarrassment and humiliation, damaging someone's social reputation or social acceptance, encouraging others to socially exclude another person, mobbing, and making negative facial or physical gestures, menacing or contemptuous looks, towards another person (Hemphill, Heerde & Gomo, 2014)

Literature Review

Bullying

Bullying as a phenomenon has been put into various perspectives by different researchers.

Bullying is longstanding violence, physical or psychological, conducted by an individual or a group and directed against an individual who is not able to defend himself in the actual situation (Roland, 2002). The National Safe Schools Framework (Noble & Grath, 2011) defined bullying as repeated verbal, physical, social or psychological behaviour that is harmful and involves the misuse of power by an individual or group towards one or more persons. Farrington (1993) defined bullying as an act of repeated oppression, psychological or physical, of a less powerful person by a more powerful person. School bullying is a social process that normally occurs in the presence of the peer group (Cowie and Sharp, 1994; Craig and Pepler, 1995).

Bullying in other Countries

In the World Health Organization's Health Behavior in School-Aged Children 2001/02, a survey of 35 countries, the average incidence rates of victims and bullies were reported to be both 11 per cent (Craig and Harel, 2004). Studies in Korea claim that bullying is a serious problem that can have negative consequences for the general school climate and for the right of students to learn in a safe environment without fear. At the least, it causes stress and suffering. At the worst, it can destroy a person's life (Lee, 2003).

Similar research in Korea by Park (1998) sampled 6,893 students in 57 primary and secondary schools throughout the country and reported an incidence of 24.2% victims. Similarly, Shon (1997) published results from a study on bullying in primary and secondary students in the province of Chollabukdo in Korea in which 23.6% of the students admitted bullying others more than once or twice in the last semester and 23.9% of children reported that they had been victimized at the same rate. Kim's study (1997), involving 1624 students of primary and secondary schools in Korea, shows a similar phenomenon of bullying. The study revealed 30% of the respondents were bullied more than once or twice in the last six months and 48.1%, surprisingly much higher than in other surveys, admitted bullying others. Besides, 22.1% of the students were involved in bullying as either victims or bullies.

In the United States, studies have found that approximately 30% of students in grades 6-10 are involved in bullying, as a perpetrator, victim or both (Harris & Willoughby, 2003; Cohn and Canter, 2003; and Bowman, 2001). Nansel, Overpeck, Pilla, Ruan, Simons-Morton, & Scheidt (2001) examined bullying issue through observation of 15,000 students in grade 6-10 in the USA and found that there is a significant association between bullying involvement and lower self-perceived academic achievement. In addition to this, Schwartz et al. (2002) mentioned that those who are frequently involved in bullying show poor academic performance in school. It is important to note that both bullies and victims had somewhat lower than average marks than children who are not involved in bullying activities (Olweus, 1978).

Sheras (2002) reported every two seconds of every school day; another student is physically attacked in school. Besides, the report from the Swedish National Education (Swedish National Agency for Education, 2010 & 2011), approximately 6-8% of the students in Swedish elementary schools (Grades 4-9) reported that they had been bullied. Bullying and harassment are not new issues that students and schools face. In fact, over the years, it has been viewed as being so common place in schools that it has been overlooked as a threat to students and reduced to a belief that bullying is a development stage that most youth will experience then get over (Ross, 2002).

Olweus' systematic study about school bullying in Norwegian and Swedish schools found that many students experienced school bullying. The findings showed that approximately 7% of Scandinavian students in the sample engaged in school bullying, and between 5% and 15% of students in various grades reported being bullied (Moon, Hwang & Luskey (2008). Other studies concerning school bullying also have been conducted in various countries such as Austria, Canada, China, England, Italy, Japan, South Korea, and the United States, and found similar or even higher percentage of samples who engage in bullying (Moon, et. al 2008; Olweus and

Solberg, 1998). All the research findings strongly affirm that the existence of bullying in schools has become a worldwide phenomenon and a problem that can create negative impacts on the general school atmosphere and for the rights of students to learn in a safe environment without fear; it can also have negative lifelong consequences both for students who bully and for their victims (Darmawan, 2010).

Bullying in Bhutan

The researcher could not find any literature about bullying done in Bhutanese context. However, National Survey on Violence Against Children and Young People in Bhutan by National Commission for Woman and Children ([NCWC], 2016) was an advantage for the researcher to put this study into Bhutanese context. It was reported that Physical violence against children is common:

- More than 6 out of 10 children (64.1%) had experienced some form of physical violence at least once in their lifetime, often occurring for the first time before 13 years of age.
- The most common forms of physical violence were associated with corporal punishment used by parents, caretakers and other relatives (43.7%) and by teachers in day schools (54.5%).
- Physical violence between peers is common, especially among boys (24.2%) and young men (22.5%).
- Few children and young people reported that they were seriously injured as a result of physical violence. However, nearly 13 per cent of the surveyed respondents reported suffering bruising, swelling or soreness (12.6%).

Theories Underlying Bullying

Bullying is strongly linked to behaviour and cognitive problem. Therefore, two theories help in explaining bullying behaviours.

Social learning Theory

"Social learning theory focuses on the learning that occurs within a social context. It considers that people learn from one another, including such concepts as observational learning, imitation, and modeling" (Grusec, 1992, pp. 220-221). Social learning emphasizes the reciprocal relationship between social characteristics of the environment, how they are perceived by individuals, and how motivated and able a person is to reproduce behaviours they see happening around them (Bandura, 1976).

Social learning theory also explains the development of bullying behaviours and attitudes in the family. Children that witness aggressive behaviours in the home and experience inconsistent feelings of safety and love have a likely chance of becoming bullies once they enter school (Bandura, 2002). Because of this inconsistent parental style of discipline, the child learns to never know what to expect. Due to this uncertainty, the child will expect the worst and act accordingly. The parents may encourage their children for physical aggression for conflict resolution with other children.

Bandura (1971) posits that people learn by observing what other people do, considering the apparent consequences experienced by those people, Rehearsing (at first mentally) what might happen in their own lives if they followed the other peoples' behaviour, taking action by trying the behaviour themselves, comparing their experiences with what happened to the other people, confirming their belief in the new behaviour. The observer will react to the way the model is treated and mimic the model's behaviour. When the model's behaviour is rewarded, the observer is more likely to reproduce the rewarded behaviour.

O'Connell (1999) has identified three conditions that influence the likelihood of imitation

and said that "children are more likely to imitate a model when the model is powerful enough; the model is rewarded rather than punished for the behaviour, and the model shares similar characteristics with child" (p.438).

During their observation, Craig and Pepler, (1995) have found that the perpetrators of bullying are hardly punished. Consequently, peers may be influenced by bullies to become involved in bullying as active participants. According to O'Connell, et al. (1999)

Bullies may influence the behaviours of peers in some ways; first, bullies capture the attention of peers by exposing the way how they engage in aggressive behaviour. Bullies who have been engaging intensively in aggressive behaviour and never been punished tend to be far more aggressive and also tend not to be more fearful of any consequences. Second, lack of sensitivity of the peers to filter the exposure of negative aspects of aggressive interaction among them may cause to the imitation of similar actions (p.440).

Bandura (1977) mentions that people contribute to their own life by selecting, influencing, and constructing their own circumstances: We are all acquainted with problem-prone individuals who, through their obnoxious conduct, predictably breed negative social climates wherever they go. Others are equally skilled at bringing out the best in those with whom they interact.

Social Cognitive Theory

Social cognitive theory (SCT) is an important heuristic for understanding the complexity of bullying behaviours and the social nature of involvement in bullying (Swearer, Wang, Berry & Myers, 2014). Social cognitive theory hinges on the same basic principles as social learning theory (Bandura, 1986). However, social cognitive theory emphasizes the role of cognitions in determining individuals' behaviours (Bandura, 1986). Specifically, the social cognitive theory proposes that there are a continuous interaction between the social environment (e.g., witnessing others' behaviours), internal stimuli (e.g., cognitions and feelings) and behaviours. This triadic interaction (i.e., social environment, internal stimuli, and behaviours) is referred to as reciprocal determinism (Bussey &Bandura, 1999; Orpinas & Horne, 2006). Thus, this triadic reciprocal determinism occurs when individuals make cognitive evaluations of the behaviours of individuals in their social environments and the consequences that follow those behaviours. Social cognitive theory has been used to explain aggressive behaviours (Bandura, 1978; Bandura, Ross, & Ross, 1961) and can be applied to the study of bullying by explaining how individuals learn to bully (via observational learning and reinforcement). Many studies demonstrate a link between observed bullying and other aggressive behaviours and perpetration of bullying behaviours among youth. For example, youth who are exposed to domestic violence in their homes are significantly more likely to bully others than those who are not exposed to domestic violence (Baldry, 2003). Children and adolescents who socialize with aggressive peers are more likely to perpetrate acts of aggression than youths who do not associate with aggressive peers (Mouttapa, Valente, Gallaher, Rohrbach & Unger, 2004). Youth have abundant opportunities to learn to bully via observational learning. However, not all youths who are exposed to bullying and aggression will imitate those behaviours. This is where roles of cognition and reinforcement come into play.

Studies by (Salmivalli & Voeten, 2004) suggest that children and adolescents may learn to bully via observational learning, but only students holding pro-bullying attitudes are more likely to perpetrate and actually engage in bullying behaviours. However, it is important to note that attitudes contain cognitive, affective, and behavioural components and reflect a mental state of readiness that influences the likelihood that one will engage in a given behaviour in the future (Allport, 1935; Fazio & Olson, 2007).

The social cognitive theory states that children and adolescents tend to avoid behaviours that they believe will be punished and, instead, engage in behaviours that they believe will be rewarded (Bandura, 1977). Thus, according to theory, youth who perpetrate bullying believe that

they will be rewarded in some way (e.g., increased social status, access to resources). Further, for the bullying behaviours to be maintained and repeated over time, individuals must receive reinforcement as a result of their bullying behaviours. Consistent with social cognitive theory, family members, adults (Bandura, 1978), and peers (Craig & Pepler, 1995; O'Connell, Pepler, & Craig, 1999) may reinforce individuals' bullying behaviours (e.g., via praise or acceptance).

Based on the evidence, children and adolescents who are exposed to bullying and other aggressive behaviours, endorse pro-bullying attitudes and interact with individuals who overtly or covertly indicate that bullying is acceptable and reinforce the bullying behaviours of these youths are likely to engage in bullying. Precisely, exposure to bullying, supportive attitudes toward bullying, and the expressed attitudes and behaviours of family members, peers, and other individuals are interrelated. The following model summarizes diverse factors that contribute to developing of human behaviours (associated with bullying and aggression).

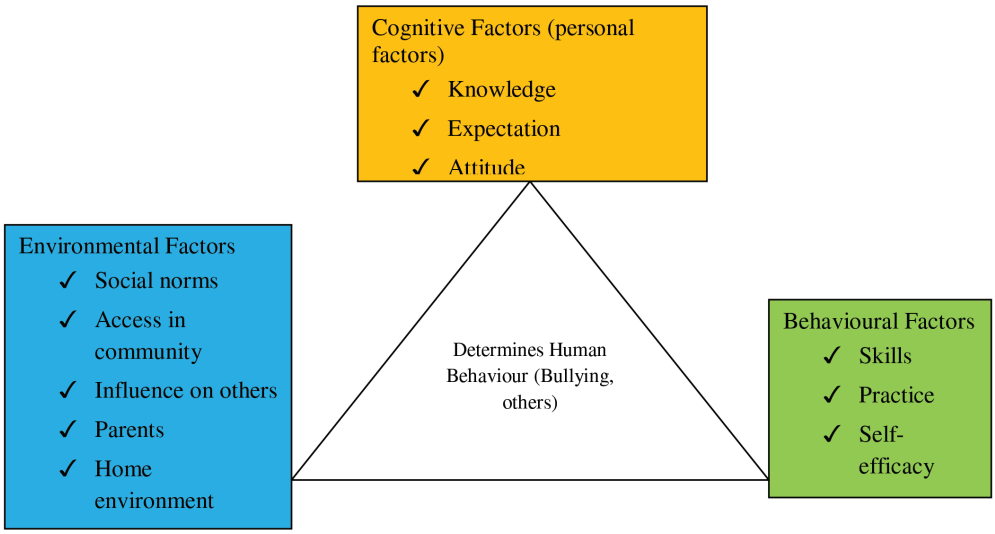

Figure 1. Model: Adopted from [Health Communication Capacity Collaborative (HC_3), Research primer, nd]

Research Methodology

Design - A random survey of students was chosen for this study since the study focussed on determining the prevalence and the dominant form of bullying in the school through quantitative measures. This survey research is used because the researcher is exploring the prevalence of phenomena, not to derive any theories. Moreover, the researcher can reach out to a large sample of the population.

Population - The population of the study comprised students of Gesarling Middle Secondary School from Class Ito IX. The age of the participants ranges from 7 to 16 years old. During the time of the study, there was no class X as it was newly upgraded. There were 650 students in the school of which 336 were boys and were 314 girls.

Sample - Random sampling technique/method was used to select the sample for the study. 20 students from each class were randomly selected using class roll numbers. The numbers were picked from a box that contained the roll numbers of all students. The sample size was calculated based on Krejice and Morgan's table. The sample size for a population of 650 students was 242, taking the confidence at 95.0% and degree of accuracy/margin of error of 0.05%. However, a total of 280 participants from class I to IX (age ranging from 7 to 16

years) were selected to ensure right sample size was maintained. However, only 262 (93.5%) participants took part in this survey and 18 (6.4%) of them were missing during the time of the survey.

Table.1: Sample distribution (n=280, 140 boys and 140 girls).

Sl.No	Class	Roll Number	Total participants
1	I	2,5,6,8,9,11,12,14,16,17,19,21,24,26,27,28,30,33,35,38	20
2	II	1,3,4,7,8,10,12,13,15,18,20,22,23,25,27,29,31,32,34,37	20
3	III	3,5,6,7,9,10,11,13,16,18,19,20,22,24,25,27,28,29,32,24	20
4	IV	1,2,6,7,9,10,13,14,16,18,19,21,22,25,26,28,30,31,32,34	20
5	V	3,4,7,9,10,11,13,16,17,19,20,22,24,25,28,29,31,32,33,35	20
6	VI	6,7,9,11,12,14,15,16,19,22,23,25,28,29,32,33,35,36,38,40	20
7	VII A	2,3,5,6,8,11,12,14,15,16,18,19,22,23,25,26,28,29,31,32	20
8	VII B	1,4,5,8,9,11,13,14,17,19,20,21,23,24,26,27,30,31,34,36	20
9	VII C	3,4,6,7,9,10,12,15,16,18,19,21,22,24,25,27,28,29,30,31	20
10	VII D	2, 3,6,7,9,11,12,14,15,18,19,21,22,25,28,29,32,33,35,39	20
11	VIII A	1,6,8,10,11,13,15,16,18,19,20,23,24,25,27,29,30,31,34,37	20
12	VIII B	4,5,7,8,10,12,13,15,16,18,20,21,22,25,26,28,29,31,33,34	20
13	IX A	3,4,7,9,10,12,13,15,16,17,20,23,26,27,30,31,33,34,36,37	20
14	IX B	2,3,6,7,10,11,13,16,17,19,20,23,24,26,30,31,35,37,38,40	20
Total			**280**

Data Collection Tools - Since primary students were included in the sample of the study, class teachers were involved to help them to understand the questions. This was to ensure that respondents give the most appropriate and authentic response. Questionnaires were used to collect data. The questionnaires from the work of Fandrem, Strohmeier, and Roland (2009) were adopted and modified to Bhutanese context. These questionnaires were generally intended to identify the prevalence of bullying and to determine the most predominant form of bullying in the school.

Three sets of survey questionnaires were developed. Set one contained 8 items covering different aspects of verbal bullying such as teasing, nick names, sexual comments, annoying remark, making fun and verbal threatening. Set two contained 8 items evaluating various aspects of social bullying such as neglecting from school activities, spreading rumours, breaking friendship, scolding, telling shameful things in public and elders forcing to do their work. Set three contained 10 items evaluating physical bullying such as friends and elders hitting each other, pinching, spitting intentionally, pushing and pulling, breaking property, making a rude gesture and captain punishing students.

Data collection and analysis - Before administering the questionnaire, an approval from the Principal was sought. After getting approval, participants were briefed on the purpose of the study and signed the consent letter for voluntary participation. The participant's confidentiality was maintained because they only had to write their age and sex; name was not required in the bio-data section.

The data collected through the survey questionnaires were punched in Microsoft Excel according to the format designed for computation. Descriptive Statistics such as graphic and percentage were used to analyze the data.

Data Analysis

The data was analyzed in the sequence of the three types of bullying covered in the study i.e verbal bullying, social bullying and physical bullying. The three types of bullies were compared to find the most common one in the school.

Verbal bullying

Table 2: Verbal bullying

Sl. No	Statements	Not at all	2-5 times in a day	5-10 times in a day	More than 10 times	Omitted	Total
1	Have you ever been teased by your friends in the school?	62	161	23	9	7	262
2	Do your friends call you by a nick name?	73	31	102	50	6	262
3	Does your friend give a sexual comment?	140	90	19	8	5	262
4	Do your friends make an annoying remark?	60	157	37	2	6	262
5	Have you come across your friends making fun of you?	58	56	96	47	5	262
6	Did anyone threaten you verbally?	117	110	26	5	4	262
7	Do your friends call you by your complexion?	225	27	6	1	3	262
8	Does your friend describe you by looking at your body structure?	212	35	13	1	1	262

Four out of eight statements (statements 3, 6, 7, 8) had the highest frequencies in the 'Not at all' option. This indicated that forms of verbal bullying such as sexual harassment, criticizing complexion and physical appearance were not common. However, five out of eight statements (statements 1, 2, 4, 5, 6) showed highest frequencies either in '2-5 times a day' or '5-10 times in a day'. This indicated that other forms of verbal bullying such as teasing (statement 1), calling by nick names (statement 2), making annoying remarks (statement 4), friends making fun (statement 5) and verbal threatening (statements 6) was common among students.

Social Bullying

Table 3: Social bullying

Sl. No	Statement	Not at all	2-5 times in a day	5-10 times in a day	More than 10 times	Omitted	Total
1	Does your friend neglect you from any activities?	30	73	109	47	3	262
2	Have you seen children telling other friends not to be your friend?	128	81	43	8	2	262

3	Do your friends spread rumours about you and others?	96	37	122	3	4	262
4	Do your friend and elders scold or punish you in the public?	180	64	12	2	4	262
5	Do your friend and elders announce your name in the public when you misbehave?	172	81	4	0	5	262
6	Does your friend tell you shameful things in the public?	150	22	57	28	5	262
7	Do your elder friends force you to work for them?	144	90	14	9	5	262
8	Do the elders make you carry & wash their plates?	188	49	20	3	2	262

***Highest**

Six out of eight statements had the highest frequency in 'Not at all' option. This indicated that the level of social bullying in the school was low. However, the first and the third statements had the highest frequency in the '5-10 times in a day' option which indicated neglecting from participating in activities by their friends and friends spreading rumours about a student were prevalent.

Physical Bully

Table 4: Physical bullying

Sl. No	Statement	Not at all	2-5 times in a day	5-10 times in a day	More than 10 times	Omitted	Total
1	Do your friend and elders hit you?	215	30	6	1	10	262
2	Have you seen your friends and elders hitting your friends in the school?	78	133	42	3	6	262
3	Does your friend hit you?	140	94	21	2	5	262
4	Does your elder pinch you?	163	72	10	4	13	262
5	Does your friend pinch you?	86	124	34	6	12	262
6	Did you ever come across your friends spitting at you, intentionally?	143	79	29	2	9	262
7	Did anyone push/pull you and hurt you?	96	133	21	5	7	262
8	Did someone take your property and break it purposefully?	156	73	25	1	7	262
9	Have you seen your friends making rude hand gestures?	110	102	38	7	5	262
10	Do your captains punish you?	184	55	12	2	9	262

Seven out of ten statements (statements 1, 3, 4, 6, 8, 10) had the highest frequency in 'Not at all' options. This indicated that physical bullying in the school was low. Three out of ten statements (statements 2, 5, 7) had the highest frequency in '2-5 times in a day' option which indicated that friends and elders hitting (statement 2), friends pinching (statement 5) and pushing or pulling (statement 7) are prevalent in the school.

Table 5: Bullying in class I to IX (Average)

Types of bullying	Not at all	2-5 times in a day	5-10 times in a day	More than 10 times	Omitted
Verbal bullying	40.95%	40.58%*	13.70%*	4.16%*	0.61%
Social bullying	56.92%	40.40%	1.59%	0.50%	0.59%
Physical bullying	49.83%	38.15%	9.23%	1.17%	1.61%

**highest*

It was clear from Table 5 that verbal bullying had the highest percentage of students for all three options '2-5 times'(40.58%), '5-10 times'(13.70%) and 'more than 10 times'(4.16%) compared to the percentages in the other two types of bullying. This is illustrated in Figure 2 below:

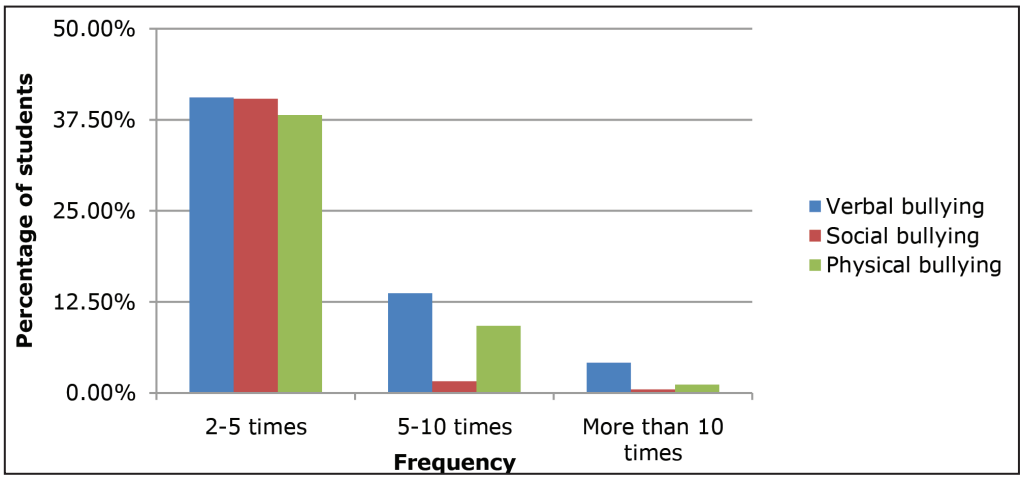

Figure 2. Frequencies of different forms of bullying

It indicated that verbal bullying was more common among students compared to social and physical bullying.

Conclusion, Discussion and Recommendation

Conclusion - The aim of this study was to investigate the prevalence of bullying among students of Gesarling Middle Secondary school in Dagana Dzongkhag and also to identify the dominant form of bullying. The following are the conclusions from this study:

1. Most forms of verbal bullying were low, however, teasing, calling by nicknames and making annoying remarks were slightly more.
2. The level of social bullying was low, however, neglecting by friends and spreading rumours were common.
3. All forms of physical bullying were low except pinching, pushing and pulling.

4. From the three types of bullying, verbal bullying was slightly higher than social and physical bullying.

Discussion - The study revealed a low level of social, physical and verbal bullying in GMSS indicating a safe, bully free environment in the school. It indicated that student in this school is less likely to experience the negative effects of bullying. The low level of bullying in the school supports the education system's GNH vision of providing education where students learn with joy and a mutual sense of support (GNH, 2013). It also fulfils the vision of Royal Education Council of Bhutan (2012) to provide quality education by creating child-friendly schools. Following the provisions of the Child Rights Convention (CRC) to prevent children from physical abuse such as bullying by friends and corporal punishment by teachers, studies have been carried out to determine the level of physical abuse in schools in Bhutan. One such study was carried out by the National Commission for Women and Children (NCWC) in 2016 which reported fewer incidents of corporal punishment and other physical violence in schools. This study showed a low level of bullying in GMSS concurrent with the finding of NCWC (2016). In the light of these findings, it may be stated that forms of child abuse such as bullying by friends and corporal punishment by teachers are declining in Bhutanese schools. The school leaders, teachers and students of GMSS should continue to maintain the trend. It must be ensured that students have a safe environment free from threats and violence because children cannot learn effectively if they fear for their safety. Troubled young people, both bullies and victims need a supportive environment to learn and grow (Olweus, 1993).

Although the general findings indicated a low level of all three forms of bullying, there were certain components in each type that was slightly high. Notably, verbal bullying (Calling nick names, making fun of each other, passing annoying remarks and teasing) was slightly higher compared to social bullying and physical bullying (See Table 5).Studies consistent with this finding are a comparative study between Austria and Japan by Greimel and Kodama (2011) who found verbal bullying the most common form in both the countries. A study was done in schools in Indonesia by Darmawan (2010) also revealed that verbal bullying such as calling names and teasing was common.

Although it is insignificant, measures must be taken by the school to prevent it from taking root. Children must be taught to show respect to their friends and be well mannered in their speech. Studies by Katie Hale (2014) and Centre for Relationship Abuse Awareness (2010) have shown that verbal bullying could have negative impacts on the victims such as poor self-esteem, inability to tell truth from lies, approval addiction formed out of a need to please another individual due to past bullying, depression, feelings of helplessness and thoughts of suicide. Similarly, studies by Donoghue, Almeida, Brandwein, Rocha & Callahan (2014) found becoming a victim of verbal and social bullying in middle school can lead to illness, psychological stress, and maladjustment.

Few aspects of social bullying such as neglecting from participating in activities by their friends and spreading rumours were slightly higher. These must also be stopped from growing. In physical bullying hitting by elders, pinching and pushing or pulling were slightly high. Efforts must be geared towards reducing these forms of bullying. A study by Rigby (2003) and Roland (2002) has shown that students affected by bullying run a higher risk of developing depression, anxiety, loneliness, distrust of others, poor social adjustment, low self-esteem, poor academic achievement and health problems as compared to others. Researchers have long demonstrated that being involved as both a perpetrator and victim pose a greater risk for self harm, suicidal ideation and suicidality, physical injury, substance abuse, negative attitudes toward school, absenteeism, poor perceptions of school safety, aggression, and delinquency (Berkowitz & Benbenishty, 2012; Srabstein & Piazza, 2008). Therefore, all forms of bullying must be controlled at early stages so that children in the school do not face the grave consequences of bullying.

The bullying behaviour is the result of multiple factors. The environmental factors that contribute to the development of bullying behaviours are family, home environment, school environment, friends and the community at large. Social learning theory considers that people learn from one another, including such concepts as observational learning, imitation, and modelling. Fried & Fried (1996) felt a pattern of behaviour could begin as early as age two; the older the child becomes the more difficult it is to relearn behaviour. Besides, a child who gets into the habit of dominating and whose parents fail to intervene may also grow up assuming that physical, verbal, social abuse are both effective and normal. In many cases, they also come from households where they are rarely supervised, parenting and discipline are inconsistent, and parental warmth is low or absent. The findings from this study confirmed that there is a low level of bullying in the school. This further confirmed that the school environment is safe and free from intimidation; children observed positive behaviours and good models. Children in good school environment have positive social interactions and psychological development. Thereby, children learned and exhibited good behaviours. The low level of bullying in the school is attributed to good school environment.

The findings from the study indicated that bullying is prevalent in the school. Although the level of bullying is low, it is a matter of concern for the teachers, school leader and the education ministry because bullying hinders the learning and performance of children in the schools (Shellard &Turner, 2004; Lumsden, 2002). It also affects the cognitive development and physical development of a child (Lee, 2003; Bandura, 1978). These findings will help the school leaders, educationist, parents and individuals to be aware of such phenomenon which can actually cause massive damage. It will also give an opportunity for the school leaders, teachers and educationist to develop a policy to stop or keep the children away from any kind of bullying in the schools.

The study also found that some forms of bullying (verbal, social and physical) are also prevalent in the school, although it was very low. So, children in the school are prone to the negative impact of bullying such as anxiety, anger, aggression, low self-esteem, depression, suicide, development of negative attitude, violence, crime, fights, low academic performance, school drop outs, alcohol and drug use, loneliness and poor school adjustment. These may have a serious impact on the quality of education and the performance of the children at the national and international level. Thus, findings from this study inform and create awareness to the students, teachers, leaders, parents and educationist about the prevalence of bullying in the school.

Recommendations - Although, the study found that there is a low level of bullying in school, the prevalence of few forms of verbal, social and physical bullying such calling nicknames, using annoying remarks, neglecting friends from school activities, creating rumours, pinching, pushing or pulling and friends hitting each other were found to be slightly higher. To prevent bullying in the schools, the study proposes the following recommendations:

Teachers:

1. Familiarization on school policy of safe environment where there is no bullying/create awareness on equality and equity among children.
2. Teach children to respect each other, Show good manners and Speak politely
3. Emphasize on value education: friendship, harmony, reciprocity, help, love, care, equality, equity, justice, cooperation, compassion, positive attitude, empathy, etc...

Students:

1. Learn to respect friends despite the diversity of race, culture, religion, social background & economic status.

2. Know the negative impacts of both the bully and the victim.
3. Help the victims and the school to fight against bullying
4. Learn and model good behaviours in the school and at home.

School:

1. There is a low level of bullying in GMSS. This should be continued and further strengthened
2. Develop anti-bullying policy for implementation in the school
3. Design programmes to educate and create awareness about bullying in the schools
4. Train and empower teachers on bullying to build teachers capacity
5. Emphasize on establishment of child-friendly school
6. Infuse strongly the concept of GNH and create GNH school
7. Provide platforms to the students, parents and other stake holders to work with the schools to minimize the bullying
8. Create a platform so that victims of bullying will be able to obtain appropriate counselling from a staff member or counsellor.
9. It is time to be more active. Schools should provide a safe and positive learning environment for ALL students in which an approach against bullying has to be embedded in the overall school climate.

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About the Author

Yeshi Nidup, is the Vice Principal of Norbuling Central School, Sarpang Dzongkhag. He has a Bachelor's of Education in Science (Biology and Chemistry) from Samtse College of Education. Contact: nidupy1982@gmail.com, contact number: +975 17757959. He is very keen in research activities and has received the Sherig Endowment fund for two action research projects.

LEARNING CYCLE APPROACH TO TEACH THE RELATIONSHIP BETWEEN DIFFERENTIAL AND INTEGGRAL CALCULUS

Kinley[2], Jambay Dorji[3] and Kencho Tobgay[4]

Abstract

Calculus is an important subject for science, engineering, and other fields of studies but it is abstract and difficult to learn. Calculus can reduce complicated problems to simple rules and procedures by using symbols and notations. Despite its importance, Orton (1983b) statesthat the teaching of introductory calculus always emphasizes manipulation of algebraic notations and rote learning. Students memorize algebraic procedural steps rather develop conceptual understanding. Most students learn the how instead of the why of calculus due to extensive use of algebraic symbols and notations. Therefore, graphing activities were developed based on the learning cycle approach and a lesson was taught for an hour in the classroom. This study investigates the effectiveness of the lesson in helping the students understand the relationship between differentiation and integration in calculus and to measure the students' attitude towards the learning unit. Sixty-five grade twelve science students from one higher secondary school were selected for the study. A pre-test was conducted prior to the implementation of the learning unit and after the intervention lesson, a post-test and an attitude test were conducted. The test scores showed that there was a significant improvement in the post-test scores compared to the pre-test scores. It was also found that the students perceived that the lesson was effective and enriching.

Keywords: *calculus, differentiation, integration, graphing activity*

Introduction

The ideas of calculus are one of the greatest achievements of the human intellect (Hughes-Hallett et al., 2003) since calculus has demonstrated the power to illuminate the most fundamental problems in mathematics, physical sciences, biological sciences, and engineering. Calculus has reduced complicated problems to simple rules and procedures by using symbols and notations not only to represent a shorter way of writing but also to make the solutions easier.

In contrast, the teaching and learning of calculus begin with the symbols and notations and is followed by several examples of its applications (Young et al., 2011, Gaidi &Ekholm, 2015.).Orton (1983a and 1983b) and Tall (2012) research studies have shown that lecture-based teaching methods are the predominant choices in calculus instruction for decades. Students develop skills in memorizing formulae and algebraic procedural steps instead of conceptual understanding (Jones, 2013& Tall, 1975). In addition, a vast number of calculus textbooks are available, covering every conceivable approach; these calculus textbooks contain a lot of abstract symbols and notations. A wide range of problems in the textbooks is solved using memorized formulas and procedural steps. As a result, according to Orton (1983a and 1983b), most students learn the 'how' of calculus rather than 'why' due to extensive use of notations and symbols in teaching and learning. The real meanings of symbols and notations that students learned in the classrooms are not interpreted explicitly in the context of real world situations.

For these reasons, mathematics educators felt that calculus education needed reform focusing on conceptual understanding rather than the acquisition of procedural skills

2 Senior Research Officer, Bhutan Council for School Examinations & Assessment kinley@bcsea.bt / kinleay@education.gov.bt

3 Head of Mathematics Department, Motithang Higher Secondary School jambaydorji@education.gov.bt,

4 Teacher, Motithang Higher Secondary School kenchotobgay@education.gov.bt

(Peterson, 1986; Steen, 1988). Since the calculus reform movement began, much research has been conducted on concept-based approaches to teach the fundamentals of calculus, e.g. a realistic approach (Kaput, 1994), a guided reinvention (Gravemeijer & Doorman, 1999), a computer-assisted approach (Lang, 1999), and a graphical approach (Tall, 1986). Most of these approaches employed contextual examples (e.g., distance and velocity of a moving car) without the real activities. As a result, students were required to imagine the context of the situations. If students cannot form clear mental pictures of contextual examples, they memorize the steps and follow rote learning (Tarmizi, 2010).According to Asiala et al. (1997) graphing is a powerful tool in teaching as well as learning calculus. Graphical representations in calculus can help students to visualize underlying concepts. Graphs can translate and interpret algebraic formulas and data. Moreover, graphs often reveal mathematical results simply and clearly.

Students have a vague concept of algebraic notations in relation to geometric interpretations (Jones, 2017). Mundy and Graham (1994) also reported that the difference between the performances on the procedural items and the conceptual ones was due to students' separate understanding of the geometrical and algebraic context in calculus. From the pilot study, which was carried out in undergraduate students, they had difficulty in explaining the relationship between differentialand integral calculus. They recognized that "integration is the inverse process of differentiation" whereas they remained silent when asked to explain "how". Since the concepts of calculus are originated from contextual applications, using contextual activities then interpreting them in the form of graphs may ultimately help students to relate the concepts of calculus to algebraic symbols and notations. In addition, the students may then get the physical feel and visualization of the concepts.

This study focused on the development of graphing activities based on the learning cycle approach to help students to establish the relationship between differentiation and integration in calculus. The main objectivities of this study were to find out the effectiveness of the developed learning unit on the students' understanding of the relationship between differentiation and integration in calculus and to measure the students' attitude towards the learning unit. This study aimed to address the following research questions;

i. To what extent can the learning unit enhance students' understanding of the relationship between differentiation and integration in calculus?
ii. What is the students' attitude towards the learning unit?

The Learning Cycle Approach

The learning cycle approach is an inquiry-based teaching model, which first emerged in the 1960s when Robert Karplus and his colleagues implemented in the Science Curriculum Improvement Study (SCIS) program (Lawson et al., 1989). It was developed by Robert Karplus based on the constructivist theory of intellectual development proposed by Jean Piaget (Karplus, 1980). In Piaget's intellectual development, the learning is not viewed as a transfer, but as an active construction of knowledge by the individual based on the knowledge already held (Piaget, 1952).

The learning cycle approach has an advantage in learning by ordering the instructional activities to be compatible with Piaget's notions of cognitive development. In order to facilitate accommodation, the activities in the exploration phase expose the learner to a segment of the environment that demonstrates the information to be accommodated. In the second phase, the activities help the learner to accommodate the information. Finally, to organize the accommodated information, the activities are developed to help the learner to see the relationship between new information and other previously learned information (Abraham, 1997).

Karplus and his colleagues originally named the phases in the learning cycle approach as; Exploration, Invention, and Discovery.Many authors have modified the names of these

phases, e.g. Barnes (1976), Driver (1986), Karplus (1978), Erickson (1983), Nussbaum and Novic (1981), Renner (1982), and Rowell and Dawson (1983) but the learning format and sequence of the phases remain the same (Lawson et al., 1989; Sunal, 2007). Furthermore, the phases of exploration, concept introduction and concept application described by Anton Lawson (1988) and Michael Abraham (1989) are the foundation phases most closely related to the pioneer in the learning cycle, Robert Karplus, and called Lawson-Abraham model of learning cycle.

The Lawson-Abraham's model of learning cycle consists of the Exploration, the Concept Introduction, and the Concept Application phases and it is the one adopted in this study.

(i). Exploration phase

This is the most active phase for the students. They learn through their own actions and reactions with minimum guidance in an activity to expose them to the concepts. The students try out their knowledge by observation and investigation through the activity. The students are expected to encounter situations that they cannot explain with their present ideas or reasoning patterns. The teacher acts a facilitator by probing guiding questions and serving as a resource for the students.

(ii). Concept Introduction phase

In this phase, the concept is introduced and explained with help from the teacher. The concept is usually derived from the data or classroom discussions. This step should always follow exploration and relate directly to the pattern discovered during the exploration activity. The students should be encouraged to identify as many new patterns as possible before the concept is revealed to the class.

(iii). Concept Application phase

In this phase, the students explore the usefulness of the concept they have learned and apply it to new situations. This phase is necessary to extend the range of applicability of the new concept. Without a number and variety of applications, the concept's meaning may remain restricted to the examples used at the time it was initially defined and discussed. In addition, application activities aid students whose conceptual reorganization takes place more slowly than average or who do not adequately relate the teacher's original explanation to their experiences.

Methodology

Participants - Single group pre-test post-test research design was used in this study. Two sections of grade twelve sixty-five science students from one of the higher secondary school were selected for the study. These students had already learned introductory calculus in grade eleven.

Procedures - A pre-test was conducted for sixty minutes prior to the intervention. The learning unit on the establishment of a relationship between differential and integral calculus was taught for sixty minutes. At the end of the instruction, a post-test and an attitude test were conducted.

A same set of five open-ended questions was used for both the pre-test and the post-test. The first question examined whether students could relate the graph of an anti-derivative to that of its derivative as well as the units in those graphs in the straight-line motion context. The second question examined whether students could relate the graph of a derivative to that of its anti-derivative in the same context. The third and fourth questions examined the students' conceptual understanding of integration and differentiation respectively. The fifth question

examined how students relate the derivatives (slopes of the lines) to the integrals (areas under the lines) of the lines, and also to examined how students establish the relationship from differentiation to integration

The attitude questionnaire consisted of twelve Likert-type items and three open-ended questions. The purpose of the questionnaire was to find the students' attitude towards the relationship between differentiation and integration and towards the learning unit. The Likert scale in the questionnaire included "1 = Strongly disagree", "2 = Disagree", "3 = Neutral", "4 = Agree" and "5 = Strongly agree".

A paired sample t-test was used for data analysis to determine whether significant difference between the pre-test and post-test scores exists. The Cronbach's Alpha reliability coefficient of the post-test was 0.67. The frequencies of the responses to each questionnaire item were separately tabulated and interpreted. The Cronbach's Alpha reliability coefficient of the questionnaire was 0.82.

Graphing activities learning unit - The Lawson-Abraham model of learning cycle was used to frame the development of a learning unit on the relationship between differentiation and integration in calculus, which employed graphing activities. The students were divided into groups of 5 students. All the instructions for the group activities were provided on the worksheet given to the students. The details of the activity in each phase of the learning cycle are described below.

(i). Exploration phase

In this phase, students were asked to sketch the graph of the constant speed of a moving car for five hours and to divide the area under the line into five equal parts as shown in Figure 1. Students were asked to find the area of each part under the line and to find the unit and the meaning of those areas, which should help them realize the graphical relationship between speed and distance.

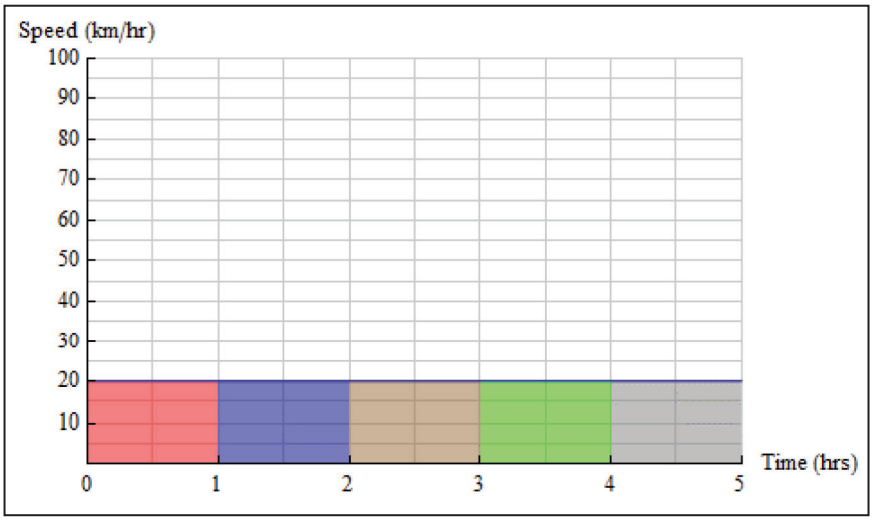


Figure 1 Graph showing the constant speed of a car and area under the line.

Students were asked to plot each area (distance) on another graph paper and compare the two graphs, which were actually the graphs of a derivative and its anti-derivative as shown in Figures 2–6. Students found the area under the line from $t = 0$ to 1 hour, 1 to 2 hours, 2 to 3 hours, 3 to 4 hours, and 4 to 5 hours (see Figures 2(a)–6(a)) and sketched the area on another

graph as shown in Figures 2(b)–6(b), which eventually yielded the area under the speed-time graph (see Figure 7(a)) and the distance-time graph (see Figure 7(b)). They were further asked to find the equations of the two graphs in Figure 7. Being more familiar with algebraic notation, the equations should help them in confirming the relationship between the two graphs.

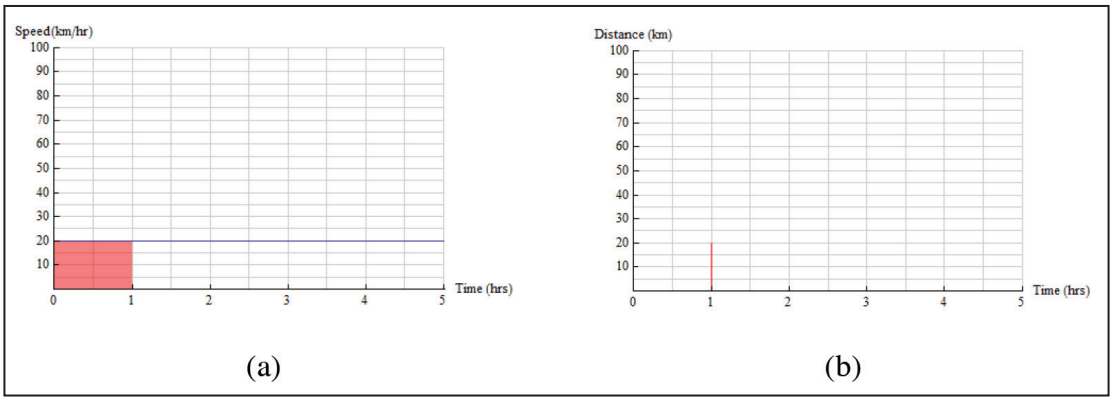


Figure 2 Area under the line and distance during the first hour

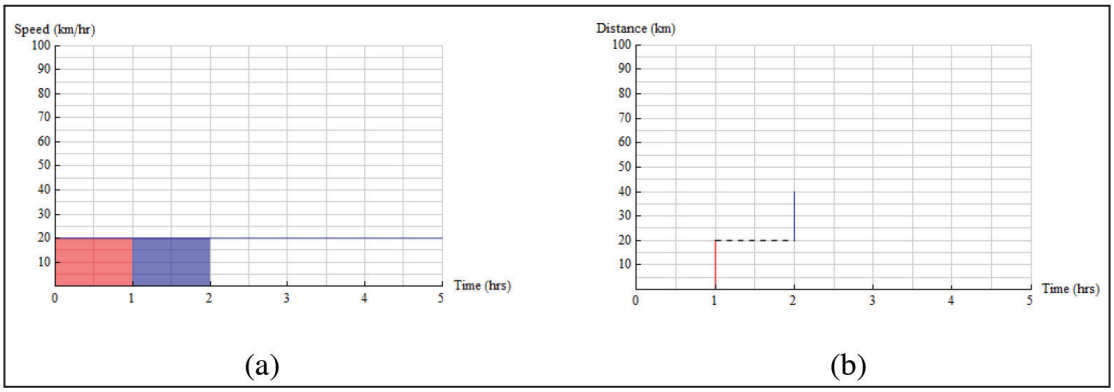


Figure 3 Area under the line and distance during the second hour

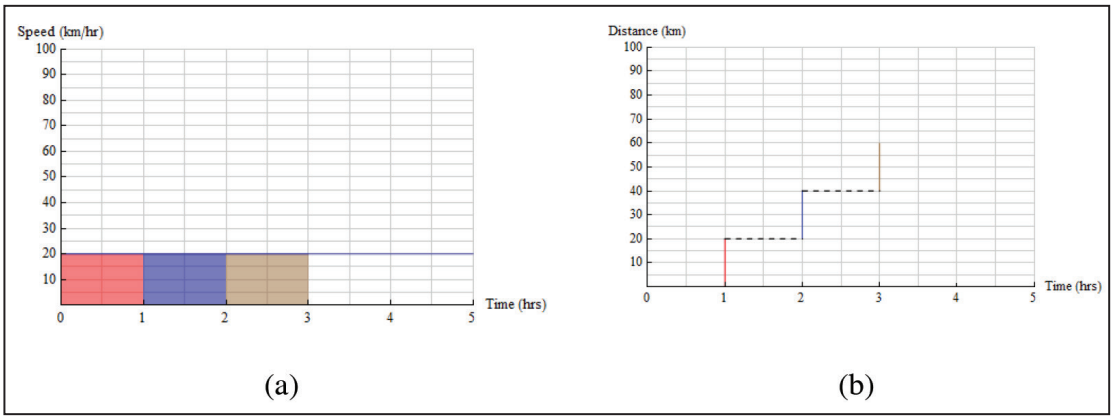


Figure 4 Area under the line and distance during the third hour

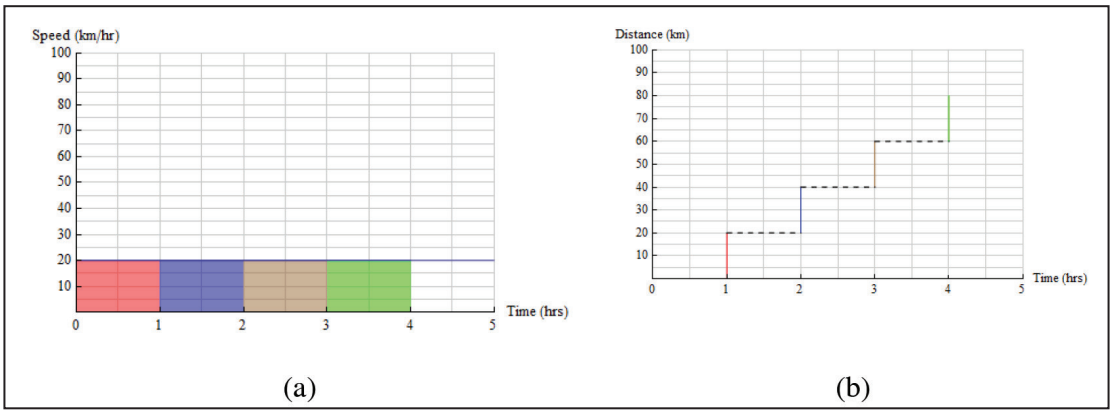


Figure 5 Area under the line and distance during the fourth hour

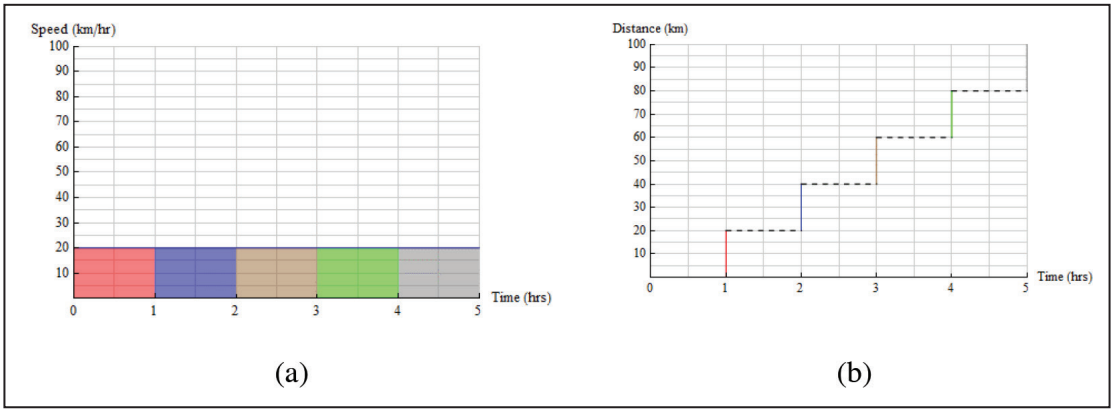


Figure 6 Area under the line and distance during the fifth hour

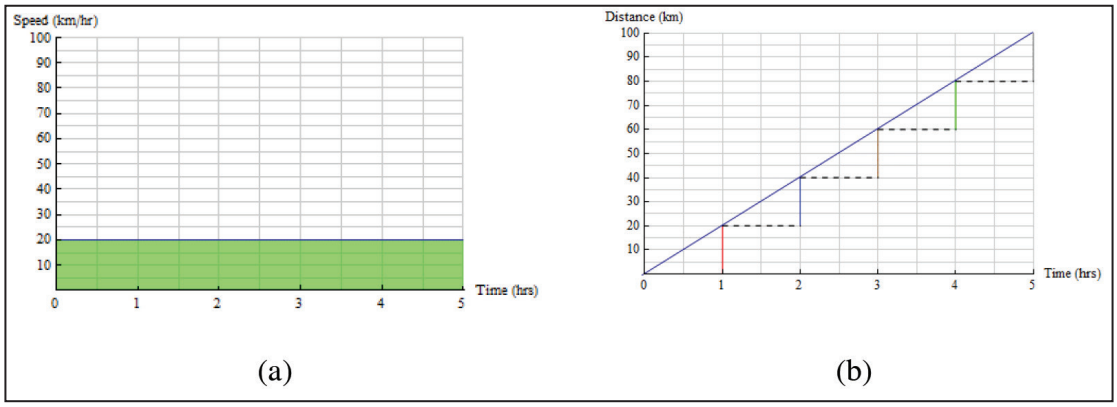


Figure 7 Area under the speed-time graph and slope of the distance-time graph

To help students see that the graphical relationship work for non-integers as well, they were asked to find the areas and the distances during the last half hour prior to t = 0.5, 1.5, 2.5, 3.5 and 4.5 hours as shown in Figure 8–12.

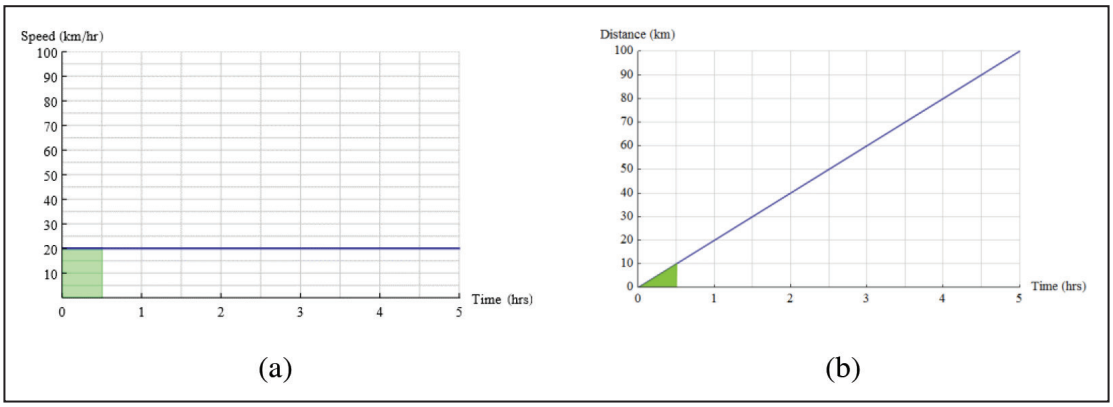


Figure 8 Area under the line for $t = 0.5$ *hours and slope of the line at* $t = 0.5$ *hours*

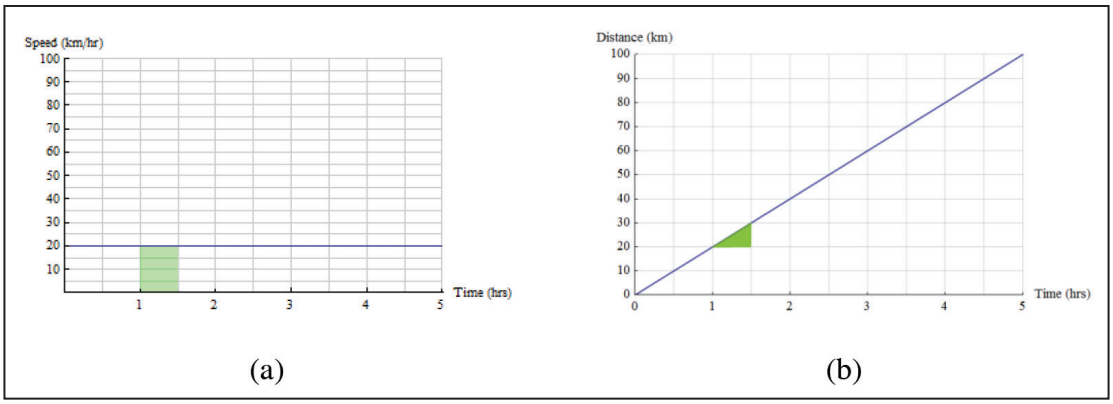


Figure 9 Area under the line for $t = 1.5$ *hours and slope of the line at* $t = 1.5$ *hours*

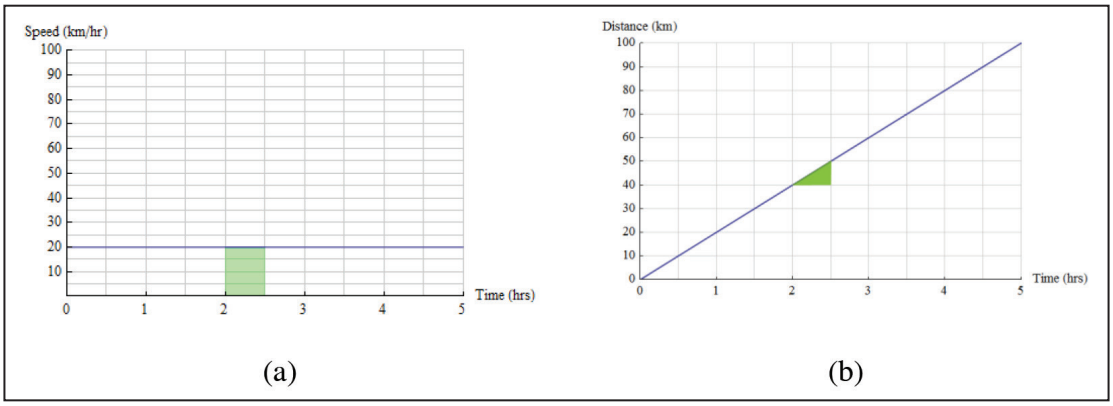


Figure 10 Area under the line for $t = 2.5$ *hours and slope of the line at* $t = 2.5$ *hours*

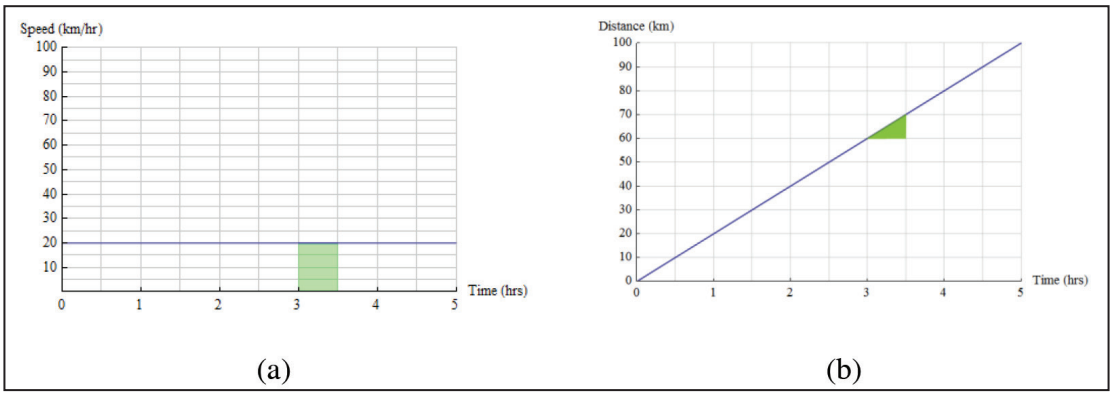


Figure 11 Area under the line for $t = 3.5$ *hours and slope of the line at* $t = 3.5$ *hours*

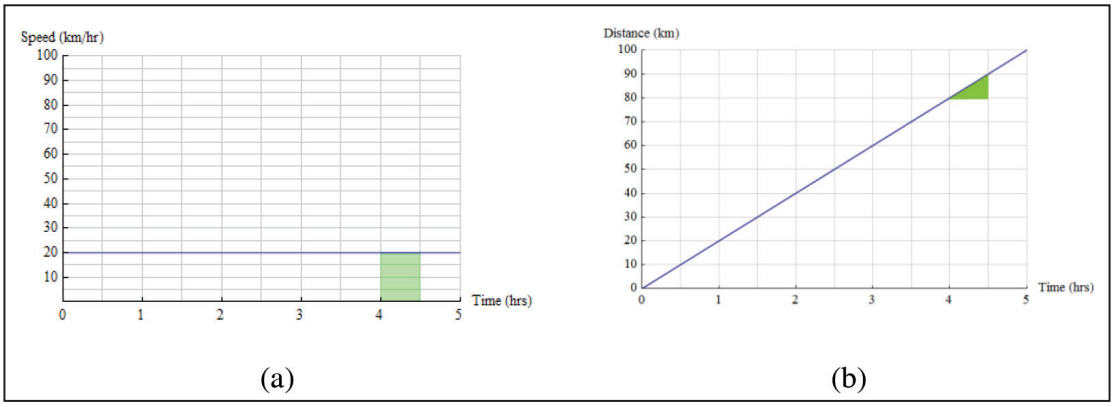


Figure 12 Area under the line for $t = 4.5$ *hours and slope of the line at* $t = 4.5$ *hours*

Finally, they were asked to directly calculate the area under the line in Figure 7(a) from $t = 0$ to $t = 5$ hours by integration and to confirm that the result agreed with the area and the distance in the two graphs. They were also asked to find the slope of the line in Figure 7(b) at 0.5 hours, which gave the point on the line at $t = 0.5$ hours in Figure 7(a).

(ii) Concept introduction phase

From the exploration phase, it was intended that students should begin to have an idea about the relationship between differentiation and integration. The concept introduction phase was intended to help them formulate the idea more completely. The students were asked the following questions.

What do you get if you find the area under the graph in Figure 7(a) by integrating the equation of the line from $t = 0$ to $t = 5$ hours algebraically?

What is the unit of the area? And what does the unit of the area tell you?

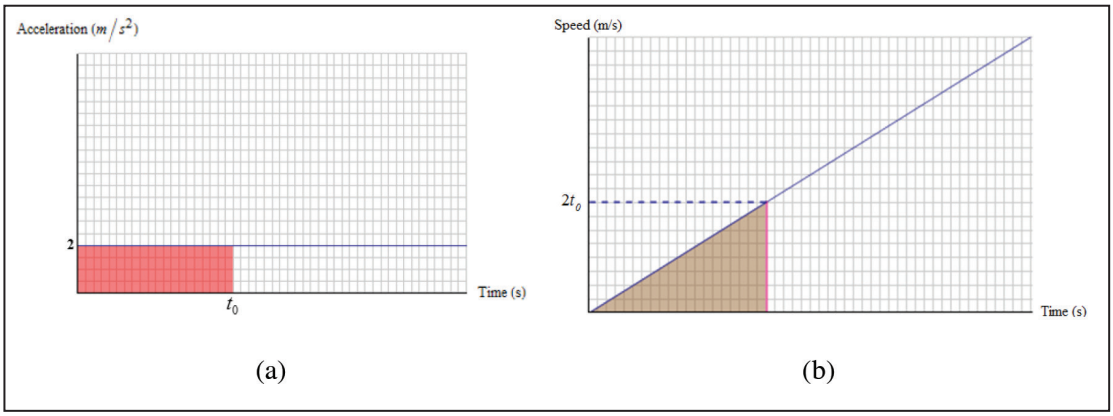
These questions were intended to help the students to see that finding the area under the line and integrating the line of the equation would give 100 km, which would indicate the distance travelled by car in 5 hours as shown in Figure 7(b). Then, the students were also asked the following questions.

What do you get if you find the slope of the line graphically and differentiate the equation of the line algebraically of the graph in Figure 7(b)?

What is the unit of the slope?
These questions were then intended to help the students to see that the finding the slope of the line graphically and differentiating the equation of line algebraically would give 20 km/hr which would indicate the speed of the car on the graph as shown in Figure 7(a). Then, the students were asked; do you see any relationship between the graphs in Figures 7(a) and 7(b) in terms of differentiation and integration in calculus? Explain?
It was hoped that now, the students would be able to see the relationship between differentiation and integration graphically, algebraically, and contextually from the activity and to conceptually understand that integration is the inverse process of differentiation.

(iii) Concept application phase

In this phase, the context was still a moving car but accelerating at 2 m/s^{2}for 10 seconds instead of travelling at a constant velocity. From the exploration and concept introduction phases, it was intended that students should have an idea how to figure out the equation of the area under the line from a given graph in general. The students should then be able to figure out the equations of the lines from the graphs as shown in Figure 13. Finding the area of the shaded region under the graph in Figure 13(a) would yield $2t_0$ which could be generalized to the equation of the line ($v(t) = 2t$) in Figure 13(b), and finding the area under the shaded region under the graph in Figure 13(b) would give $\frac{1}{2} \times 2t_0 \times t_0 = {t_0}^2$ which could be generalized to the equation of the line in Figure 13(c)



(a) (b)

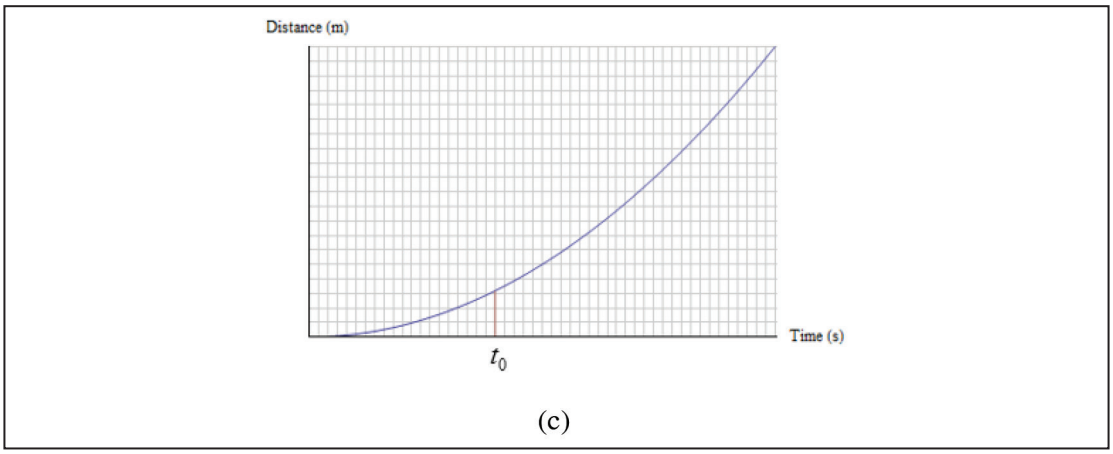


Figure 13 Graph showing how to derive the general equations of the lines

The students were asked to sketch the acceleration-time graph, to find the area under the graph as shown in Figure 14, and to plot the area, which was, in fact, the velocity, on another graph paper as shown in Figure 15. Then, finding the area under the graph in Figure 16 would give the distance, whose graph is shown in Figure 17.

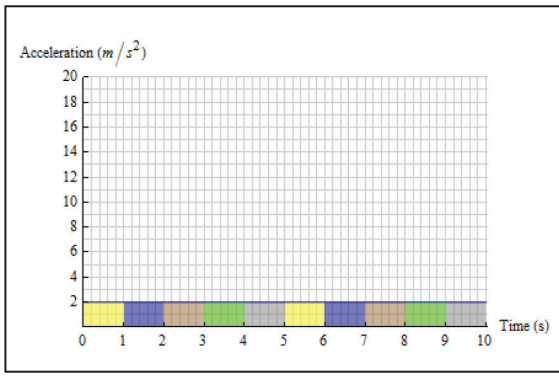


Figure 14 Acceleration-time graph.

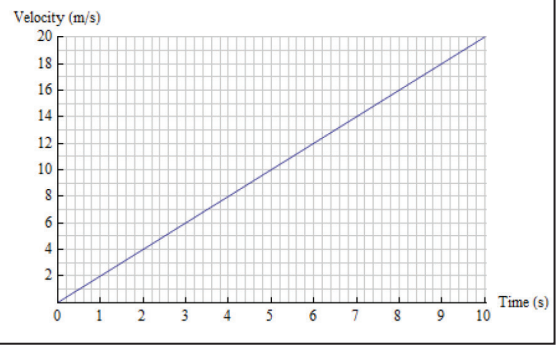


Figure 15 Velocity-time graph.

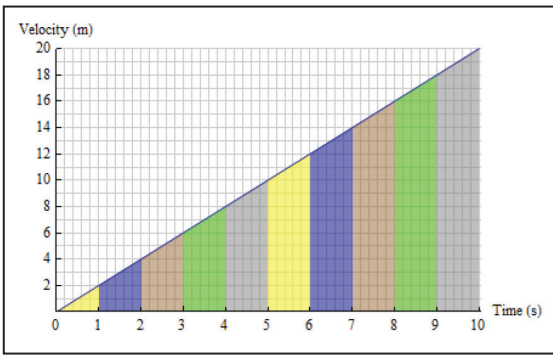


Figure 16 Velocity-time graph showing area under the line.

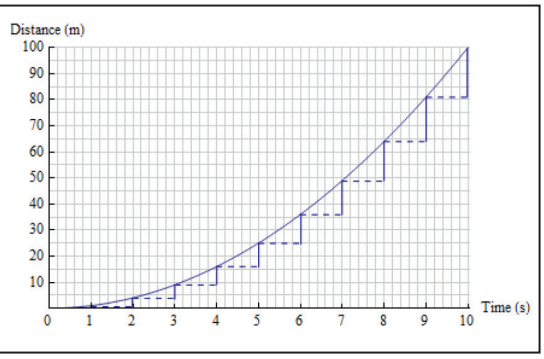


Figure 17 Distance-time graph.

Finding the derivatives of the distance-time graph in Figure 17 would give back the velocity-time graph in Figure 15 and finding the derivative of the velocity-time graph would give the acceleration-time graph as shown in Figure 16. Then, students could use the algebraic method of integration to confirm the findings of the velocity-time and distance-time graphs from the graphical method and the same was true for the reverse process of differentiation. It should be noted that the non-linearity of the distance-time graph could also be used to emphasize the instantaneous nature of a derivative, both graphically and algebraically.

Results

Students' performance

To answer the first research question, a paired sample t-test was calculated using Statistical Package for the Social Sciences (SPSS) software. The average post-test score was significantly greater than the average pre-test score (see table 1). After the intervention, there was a significant improvement in students' performance. The mean score in the pre-test was extremely low as many students found the questions difficult, which indicated that students had little or no conceptual understanding in regard to differential calculusand integral calculus in general and to the relationship between differential and integral in particular. Some of the students much higher in the post-test despite the fact that the intervention lasted for only sixty minutes. The intervention lesson was focus using graphs in relation to the contextual situations. The students find difficult to capture the concepts as they were acquainted dealing with algebraic symbols and notations from earlier classes on calculus. The teachers teach the way they were taught as textbook deals with lot of algebraic symbols and notations.

Table 1 Paired sample t-test of pre-test and post-test result

Test	Mean	Standard deviation	t	Sig. (2-tailed)
Pre-test	4.36	3.09	16.83	0.00
Post-test	13.50	3.27		

Students' attitude towards the learning unit

The questionnaire was administered to 65 students for 30 minutes after the post-test to address the second research question: What is the students' attitude towards the learning unit? The questionnaire consisted of twelve closed-ended Likert-scale questions and one open-ended (1) suggestions and comments regarding the activities in the learning units. (See Table 2)

The students' responses to each Likert-type item were analysed by the frequency and mean of the students' responses to determine the students' attitudes towards the learning units as shown in Table.2

Table 2 Students' responses to the questionnaire.

	Items	1	2	3	4	5	Mean	SD
1	I like the activities in learning calculus.	1	5	8	28	23	4.03	0.97
2	I found the graphing activities in the calculus lessons interesting.	1	5	11	35	13	3.83	0.89
3	It was too difficult to learn calculus by doing graphing activities.	11	23	19	7	5	2.57	1.13

	Items	1	2	3	4	5	Mean	SD
4	I find reading the textbook in detail is by itself sufficient for me to learn calculus.	31	16	12	3	3	1.93	1.13
5	I learn calculus better by reflecting on these activities instead of only by book and memorizing.	1	2	7	36	19	4.08	0.81
6	I look forward to solve more problems in calculus after the activities.	6	11	17	19	12	3.31	1.22
7	I will understand better if other topics in mathematics are taught using activities like the ones used in this calculus lesson.	2	7	14	26	16	3.72	1.05
8	The time was too short for the lesson.	4	4	13	26	18	3.77	1.11
9	The calculus lessons need more exercises until I understand and become fluent.	0	3	5	26	31	4.31	0.81
10	Mathematics teacher teaching calculus is enthusiastic in teaching calculus.	0	2	24	32	7	3.68	0.71
11	Mathematics teacher teaching calculus is encouraging and approachable during the lessons.	0	6	17	34	8	3.68	0.81
12	Mathematics teacher teaching calculus taught the lessons too fast and I could not follow the instruction.	17	18	15	11	4	2.49	1.23

From the closed-ended Likert-scale questionnaire, 51 out of 65 students liked the activities in the calculus lessons and forty-eight students found the activities in the learning units interesting and enriching. Thirty-four students found that it was not very difficult to learn calculus by doing the activities and forty-seven students found that reading the textbook in detail was not sufficient for them to learn calculus. Fifty-five students responded that they learned calculus better by reflecting on the activities instead of only by reading books and memorizing, and 31 students looked forward to solve more problems in calculus after the activities. The majority of the students preferred to learn other topics in mathematics using activities like the ones used in the calculus lessons. Forty-four students found that the time was too short for the lessons in calculus and 57 students needed more exercises in the lessons.The above finding indicates that the students learn better with hands on activities and percept that learning mathematics become more enriching and easier when they do, feel and see.

The majority of the students felt that the time was too short for the lessons. The problem of time limitation was not under our control. We had to follow the mathematics curriculum issued by Department of Curriculum and Research Development, which specified in detail how long each topic should be taught. However, the majority of the students found that the instructor was enthusiastic in teaching calculus and encouraged the students in the learning process.

Discussion and Conclusion

Calculus originated from the study of motion, which is realistic in nature with rich history and experiences common to all human beings. Students are hardly taught calculus using graphs or realistic or experimentally real situations and visualization tools at higher secondary school level. Calculus are taught separately focusing on an algebraic approach, which makes it difficult to visualize the relationship between differential and integral calculus. Students just spell out the relationship by following what is written in textbooks— “Integration is the inverse process of differentiation”—and cannot explain how and why as it is difficult to visualize the relationship seeing only algebraic symbols and notations.

The pre-test result showed that the students often lacked certain conceptual understanding in differential and integral calculus from traditional methods of teaching mathematics. The findings from the pre-test questionnaire seemed to show that students had learnt calculus without actually understanding differential and integral calculus as well as their relationship. In our professional experience as teacher educators the concepts of differentiation and integration are traditionally taught by focusing only on algebraic methods at the higher secondary level

calculus course. It is likely that the students saw calculus as a series of process associated with algorithms and could not apply the concepts in the contextual situations. This agrees with Tall's (1992) findings that students instead of having conceptual view of the symbols and notations in differentiation and integration, they focus only on a process-oriented view. The students encountered difficulty in relating the functional notations of differentiation and integration to the context of motion.

The average score of the post-test was significantly higher than that of the pre-test, indicating that the developed learning unit could enhance the learning achievement of the students. The hands-on graphing activities helped the students think logically, develop their own reasoning skills, and ultimately invent their own concepts of the relationship between differential and integral calculus. Sokolowski et al. (2011) and Orhun (2012) also employed graphing activities in contextual settings to enhance students' understanding of calculus.

The findings from the attitude questionnaire seems to indicate that the students found the activities interesting and enriching probably because they took active roles in the lesson and felt motivated to learn calculus, hence leading to better performance. To really understand the relationship between differentiation and integration, students obviously need to understand both differentiation and integration, which are themselves based on more fundamental concepts like limit and continuity and discontinuity of a function. To understand these concepts, the finding indicate that lessons are more helpful when they are focused on context-based activities rather than on algebraic methods (Tall, 1992). Students usually learn and retain better when they are actively involved in the lessons and the concepts can be visualized (Cavanagh, 1996). The coverage of the fundamentals of calculus is necessary before the learning of the relationship between differential and integral calculus can take place. Such a coverage will require a much longer intervention duration. It is hoped that a coherent lesson on calculus based on contextual activities will be developed.

Learning by doing is an unreplaceable approach consistent with the constructivist theory of learning. As said in Chinese proverb "Tell me and I will forget. Show me and I may remember. Involve me and I will understand." When students are physically and mentally involved in the activities, they get the real feel of what they are doing which helps them retain what they have learned. In this study, the activities are designed to help students understand the calculus concepts better by involving physically in the contextual graphing activities.

Acknowledgement

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About the Authors

Kinley, a senior researcher at Bhutan Council for School Examinations and Assessment, holds a M.Sc. in (Science and Technology Education) from Institute for Innovative Learning, Mahidol University, Thailand. His areas of research include calculus teaching, Technology embedded in mathematics and Gross National Happiness in Mathematics Education and Rural Tourism. His research interests include Learning Assessments in Bhutanese education system, teaching methodologies, teacher commitments, nature of science (NOS), GNH in school curriculum, waste management system.

Jambay Dorji, a mathematics teacher at Motithang Higher Secondary School, holds a Post Graduate Diploma in Education from Samtse College of Education. His areas of research include teaching calculus in higher secondary school. His research interests include teaching of mathematics using 21 teaching skills in Bhutan and Physics practical using technology.

Kencho Tobgay, an English teacher at Motithang Higher Secondary School, holds a Bachelor of Education (Secondary) from Samtse College of Education. His areas of research include bilingual teaching and translations. His research interests include English language education and laws in school system.

Super Science High School in Japan: Experience and Its Implications for Bhutan

Koji Yamada

Abstract

This review paper aims at contributing to the on-going plan of the Royal Government of Bhutan to introduce the Premier School program to bring about a premier quality of education, primarily in science subjects. The concept and idea of the program was borrowed from Japan's Super Science High School (SSH) model. It first describes the outline of the SSH model and the institutional development initiated by the Ministry of Education in Japan, which wanted to evade the criticism of its departure from equality of education. Second, it highlights the role of stakeholders around SSHs and how they have responded to the requirements set forth in the new policy. Third, the impact assessment of the new policy was made in 2015 and it finds positive impact of the SSH on the students' academic path to advanced science and technology. Lastly, taking into considerations on the local conditions in Bhutan, the paper will discuss the implications of Japan's experience to the institutional development of the Premier School in Bhutan. The paper concludes that the comprehensive nature of capacity development requires a whole-of-a-community approach for each target premier school at the community level and also a whole-of-a-government approach that incorporates the efforts by each central government stakeholder.

Key words: *STI, capacity development, TVET, university, research and development*

Introduction

In August 2016, the Ministry of Education (MOE) had proposed the first Premier School in Bhutan. Like central schools, the premier school would receive increased funding to bring about a premier quality of education, primarily in science subjects[1].

The idea of the premier school is based on the recommendation on school curriculum and assessment in the Bhutan Education Blueprint 2014-2024 (RGOB, 2014). It points out that the current education structure provides only limited scope for choosing elective subjects based on student's choices. Arguing that the education system should accommodate the rapidly changing world order, the emerging new challenges and opportunities, and the changing system and students' aspirations, the Blueprint recommends that Bhutan should restructure pathways to allow more flexibility to choose subjects to cater to a range of student interest and abilities, to be more specific, by introducing more elective subjects for Class 9 to 12.

MOE's proposal was endorsed at the National Education Conference in January 2017. It aims at fostering a platform for students to explore individual talents in a wide range[2]. Although the program would start with three proposed locations in Punakha, Trongsa and Zhemgang, the number and location may be modified after further research and study. The drafting of the concept, curriculum, budget and human resources requirement will be completed by April 2017.

It is said that the concept and idea of the Premier School was borrowed from Japan's Super Science School model. It is the model developed to enhance the science education at the higher secondary level, and therefore, it is called Super Science High School (SSH). But the simple copy of the world's good practice may not ensure the success of the new policy in the Bhutan-specific contexts. According to a review of the past literature, I could find only the static description of the SSH model, or how each of the SSHs has responded to the requirements and enhanced its delivery of science curriculum. The past literature has rarely highlighted the transition from the one-size-fits-all curriculum to the contextualized and customized curriculum.

Another problem was that most of them were written in Japanese, and I couldn't find the past English literature which worked on the comparative analyses between the Japanese model and its counterparts in the world.

This paper is the first English literature to provide a comprehensive view of Japan's experience in the SSH program. I will first describe the outline of the SSH model and the institutional development, based on the discussion paper of the National Institute of Science and Technology Policy (Kobayashi, et al. 2015). Second, I describe the role of stakeholders surrounding SSHs and how they have responded to the requirements set forth in the new policy. Third, the impact assessment of the new policy was made in 2015 and I will brief on their findings. Lastly, taking into considerations on the local conditions in Bhutan, I will discuss the implications of the Japan's experience to the institutional development of the Premier School in Bhutan.3

What is "Super Science High School"?

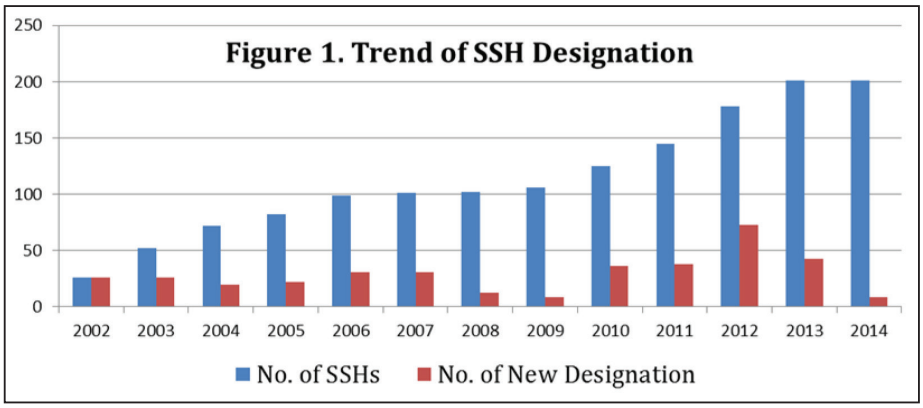
Outline

Super Science High School (SSH) is the program initiated by the Ministry of Education, Culture, Sports, Science and Technology in Japan (MEXT) in 2002. Although the program was first institutionalized by the Ministry, implementation was undertaken by an independent administrative agency, Japan Science and Technology Agency (JST). The ultimate goal of the program is to promote the development of future global leaders in science, technology and innovation (STI) while its immediate objective is to work on research and development for the betterment of the science education.

Therefore, the schools designated as SSH are primarily regarded as a school where teachers could endeavour to work on research and development for the better science curriculum. But it's also a program for the human resources development in STI, introducing the state-of-the-art technological knowledge to the school education at the senior high school level, which is equivalent to the Class 10 to 12 in the higher secondary level in Bhutan.

The SSH designation is not permanent. The designated period was originally three years for one school. But it was extended to five years in FY2005. Once the period expires, the school is not an SSH anymore. However, the government of Japan introduced special clauses that allow for a two-year extension for transition and re-designation for another fresh five years.

Once they are designated, schools are assured of special budget from the government for every fiscal year of the designated period, for undertaking the research and development activities. The SSH program started with 26 schools with the total budget of JPY 727 million in FY2002, and it has been expanded to 204 schools with JPY 2,790 million in FY2014. Therefore, the average SSH budget for each school has been decreased from JPY 28.0 million (US$ 252,000) to JPY 13.7 million (US$ 123,000) per year.



Source: Kobayashi, et al. (2015), p.16.

Background

When the SSH program was institutionalized, Japan had been facing the challenges concerning the STI policy environment. First, the comparative analyses of the OECD and other international organizations had pointed out that Japan was ranked lowest among the OECD member countries in the share of the children who positively responded to the questions: "Do you like science subjects?" and "Do you want to work on science and technology in the future?" This was strong enough evidence to create serious concerns among political leaders and officials about the public apathy toward science.

It was also the time for a restructuring of the central government in Japan, which primarily aimed at breaking organizational silos, slimming down bureaucracy, strengthening the function of the Cabinet, and ultimately enhancing the administrative efficiency of the government. As a result of the restructuring in 2001, the Ministry of Education and the Science and Technology Agency were merged to MEXT. The birth of the new ministry meant that the policies for education and STI promotion would be implemented in an integrated manner. The SSH was regarded as a program that symbolized the future policy direction of the government.

Kobayashi, et al. (2015) says that the SSH aims at introducing Advanced Placement (AP) to Japan. AP is a program in the United States and Canada which offers college-level curricula and examinations to high school students. If some high school students are identified as a human resource that has potential to stand out as a talent in STI, they should not be confined to the national course guideline or constrained by the enduring preparation for the university entrance exams. Instead, it is argued that they should be excited and highly motivated to continue to study advanced science and technology.

> The global trend in educational thoughts does not stick to the egalitarianism that insists on the equality of opportunities. Instead, it is placing higher emphasis on the aptitude and potential of each individual. We can conclude that the SSH aimed at bringing the world's good practices into the Japanese education. (p.4)

The aptitude and potential of each individual were also highlighted by Inoue and Mohri (2003).

Institutional Arrangements

Whenever the government introduces a new policy, it must be institutionalized in accordance with the existing legal framework or by enacting a new law. In the case of the SSH, MEXT applied the existing Article 55 of the Ordinance of Enforcement of the School Education Act and defined the SSH as an experimental school where teachers could deliver special science curriculum on the experimental basis. But the fact that it was introduced as an experimental school indicates that the earlier experiments in super science curricula, once they are proved effective, should be integrated into the formal education guideline for a nationwide introduction. This means that once their school becomes an SSH, the management and teachers must take a scientific approach in the way they deliver the program and bring the evidence of the impact of their new approach to the research conferences for further scrutiny. Inoue and Mohri (2003) also emphasizes the dissemination of the models built in the earlier efforts at the SSHs, as due consideration to the impact on the non-SSHs (pp.13-14).

This institutional arrangement was also convenient for MEXT to evade the public criticism against the new program. At the initial stage, since the government first indicated the SSH program, many educationalists and teachers criticized the government proposal arguing that it would create a limited number of science elites and therefore cause a great divide between the selected and the non-selected. They also criticized at the unequal allocation of educational budget between SSHs and non-SSHs. MEXT tried to make a breakthrough by explaining that the new methodologies of science education would be applied to other schools to ensure the equal access to them once their effectiveness is validated.

At the same time, MEXT also launched another policy, Science Partnership Program (SPP), as complementary arrangement accessible to any other school teacher of non-SSHs. SPP is a grant facility that enables even a single teacher to endeavour to introduce the Project-Based Learning to his/her classroom through the frequent outdoor observation, experiment and laboratory exercises. It is accessible for the lower secondary schools (Class 7 to 9), too. Under the SPP, schools could be more flexible in inviting external researchers to come and demonstrate lab-based science experiments at the classrooms, sending their students out for a study tour to universities and research institutes, and allowing their teachers to attend the external training programs on advanced science. The SPP was instrumental for MEXT to evade the earlier criticism against the non-egalitarian nature of the SSH.

At each school level, however, the SSH was a double-edged sword. While the SSHs could be granted extra budget, it also expects their strong commitment and responsibility to enhance the teaching/learning conditions for advanced scientific knowledge and prove the effectiveness of their approaches in a scientific manner. The schools must reach a consensus for collective actions to maximize the impact of the special budget and bear the responsibility to disseminate the impact.

As a supplementary measure, MEXT emphasized the collaboration with universities and research institutes. It was good news for the research community, too. During the long economic stagnation from the 1990s, the public expenditure on higher education and research had been subject to strict review and budget cut, and universities and research institutes had been struggling the way for their survival. One of the directions was the extension and outreach to schools and the local communities. If they identify and develop young human resources, the future prospect for recruitment of competent researchers will also be enhanced.

Various Actors in the Super Science High School Program

In summary, SSHs are supposed to develop special science curriculum, which doesn't necessarily comply with the national education guidelines and work on research and development of new methodology to collaborate with various external actors and a new teaching methodology to enhance students' capacity for logical and creative thinking.

While the SSH program requires the self-help efforts at the individual school level, it also expects the schools to enter into collaboration with external actors. In this section, I will apply the analytical framework of capacity development defined in JICA (2006) and (2008)1, and see who did what to ensure the effectiveness of the whole program, based on the first-year experience of a first-batch SSH described in Inoue and Mohri (2003).

School Teachers

There was no pre-set curriculum provided by the government, as one of the objectives of the program was the promotion of activities beyond the national education guidelines, This means that curriculum development was highly decentralized and each SSH could set its curriculum at its own discretion. But this also means that the science teachers at SSHs must bear an extremely heavy responsibility to customize their science program.

Once their schools are designated as SSH, they must work on the program-related activities for five years. The new responsibility has caused extra workload. Science teachers had to develop the plan of activities and coordinate with external actors. They had never had the past experience in working this way.

They needed the enabling environment inside the school. It included the better understanding and cooperation by the fellow teachers of other subjects, and they shared the burden of the oversight on the students' club activities and miscellaneous works on school administration. School principals and vice principals took a strong leadership in ensuring the enabling environment, by redistributing the responsibilities in school administration and

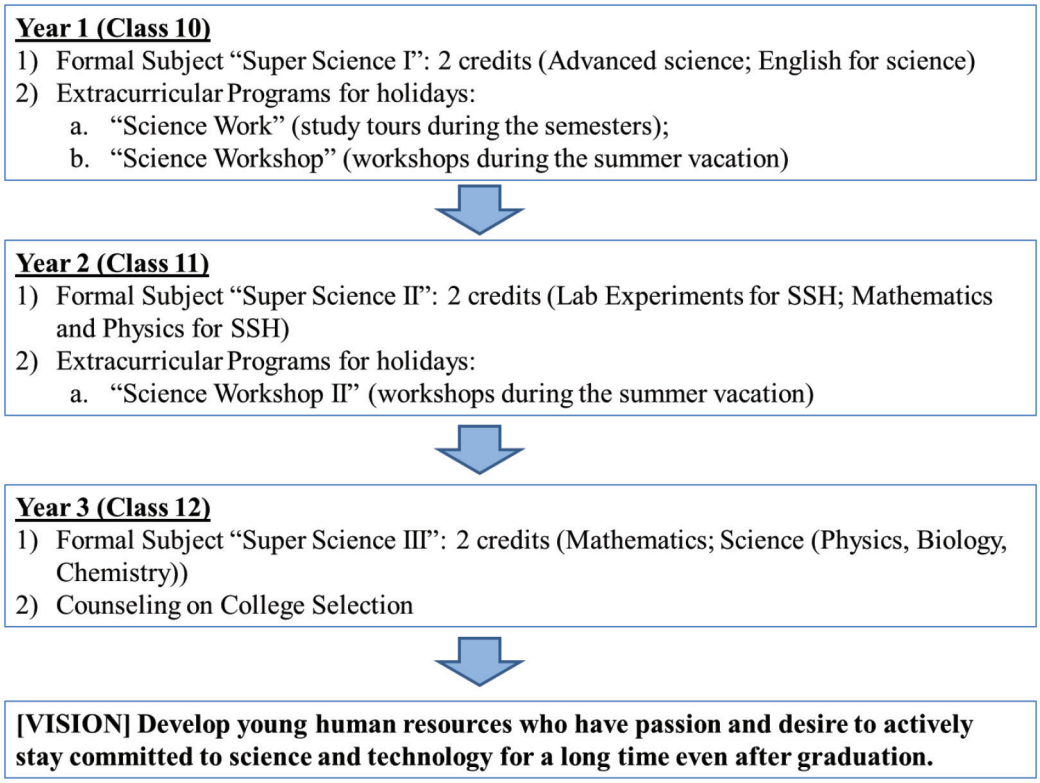
encouraging science teachers to stay engaged in the new program delivery. Principals and vice principals in most cases were directly committed to the program implementation and coordination with the external actors.

Inoue and Mohri (2003) describe the details of the experience of a school, Takasaki Senior High School (SHS) in Gunma prefecture, which was one of the first 26 SSHs designated in 2002. MEXT sent out an official notice to prefectural governments on January 15, 2002, which was further transmitted to senior high schools later. The submission of proposals was closed at MEXT on February 20. Selection result was released on April 10. Out of 77 applications, 26 were selected.

According to Inoue and Mohri, Takasaki SHS proceeded to the curriculum development in March before the nomination was confirmed. This proactive preparation helped the school to jumpstart the implementation. For the first year, they targeted only the Class 10 students, who just entered the school for a new academic year[4].

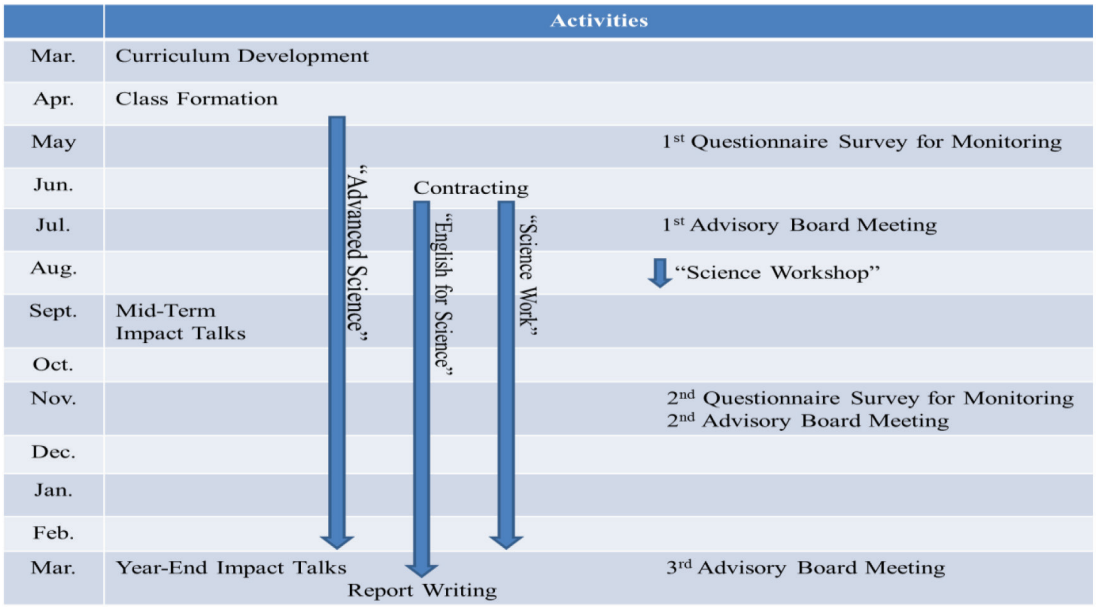
They wrote the three-year scenario for students' development depicted in Figure 2, and drew the annual work plan for the first year as depicted in Figure 3. This means that the new curriculum does not necessarily apply to all the students even inside the SSH, because of the nature of the program as part of research and development for new teaching/learning methodology.

Figure 2. Program Scenario for Students' Development at Takasaki SHS



Source: Inoue and Mohri (2003), p.38. Revised by Author.

Figure 3. Annual Activities for Class 10 Students at Takasaki SHS



Source: Inoue and Mohri (2003), p.44. Revised by Author.

In April, the school explained the new program to all the freshmen and let them choose between the standard curriculum and the super science curriculum. As a result of the needs survey, they started the SSH program with 82 students in two classrooms.

Universities and Research Institutes

It is extremely difficult for each SSH alone to develop its own new curriculum beyond the framework of the existing national education guidelines. Without the interactions with universities and research institutes which had been undertaking advanced research on STI, high school teachers could not have come up with a methodology to enhance students' exposure to the advanced science and technologies.

Besides the consultation for the new curriculum development, they were also instrumental in enhancing the education delivery. They received the study tours from the SSHs, demonstrated the science experiments and research programs they had been working on, and facilitated the students' workshops for Project-Based Learning. They also visited the SSHs as special lecturer or facilitator in the lab experiments.

Miraikan – National Museum of Emerging Science and Innovation

It was still too difficult for Takasaki SHS alone to map the places of interest and get in touch with all the institutes and companies if they were located far away from Takasaki City. Once they decided to apply for the SSH program, they contacted Miraikanat the earlier stage of preparation and consulted with the museum staff to help them identifying potential partners who could add values to their SSH program.

Miraikan was opened in Tokyo in July 2001, based on the "The Basic Plan for Science and Technology" of the government of Japan. It facilitates science communication to promote awareness, fosters personal skills as a science communicator, and creates a connection among science stakeholders.

Besides the consultation services on the curriculum development, Miraikan supported Takasaki SHS by introducing guest lecturers, such as instructors of English for scientific research and science presentation skill, receiving their students in the guided tours of the museum, and facilitating their learning process.

Other SSHs and Neighbouring Schools

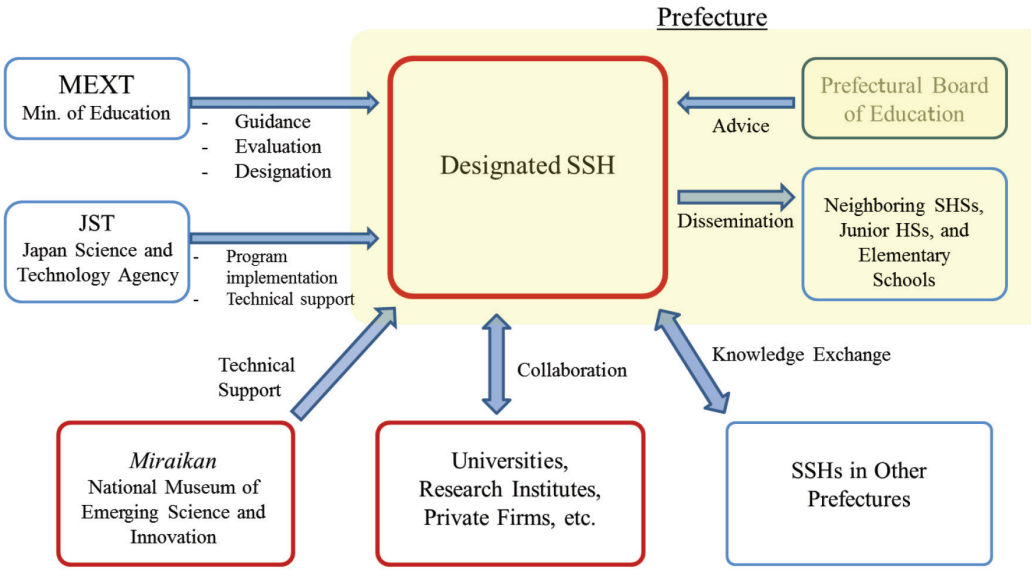
With regards to the dissemination, SSHs introduced exchange programs with other SSHs, and with other schools in their neighbourhood. In the case of Taksaki SHS, students visited another SHS during the "science workshop" tour in the first summer. Takasaki SHS participated in the program impact talks twice in a year where students themselves reported their experience and findings to the external audience, including the students from the neighbouring schools. This gave them a good chance to review and improve their own program.

Prefectural Boards of Education

In Japan, MEXT oversees the administration of the prefectural and municipal boards of education and superintendents, determines the educational budget, and subsidizes the prefectural boards of education so that it could provide equal quality education to all children across the country. Based on the budget allocated from the centre, each prefectural board hires public teachers, supervises high school education, and oversees the municipal boards of education[5].

The first call for SSH applications were notified from MEXT to all the senior high schools via the prefectural boards of education. Once a school is designated as SSH in the constituency, the board is also supposed to share the responsibility for results and scaling up across their constituency. In the case of Takasaki SHS, the Gunma Prefectural Board of Education coordinated with the neighbouring schools and organized program impact talks. In addition, the board facilitated the peer learning programs for the school teachers or principals/ vice principals working on science education at different schools and produced a teachers' handbook.

Figure 4. Various Actors Surrounding the Designated SSH - Summary



Source: Author.

Evaluations on the Super Science High School Program

Macro Impact

There are very few studies on the macro-level impact assessment of the SSH program. One of the very few attempts so far is Kobayashi, et al (2015). It conducted the statistical data analysis for the impact assessment and found the following observations.

First, the rate of students who advanced to higher education to major in STI-related subjects was about 2 to 3 times higher for graduates from SSHs than the national average. This rate is higher for female, indicating that the SSH has more positive impact on female than on male[6].

Second, the rate of students who advanced to national/prefectural/municipal colleges and universities to major in STI-related subjects was significantly higher for graduates from rural SSPs than those from urban SSHs. While urban SSHs are the schools located in the major cities, rural SSHs are those located in small local cities or in the prefectures where there are few higher education institutions focusing on the human resources development for research and development[7]. This indicates that if there are very few alternatives in colleges or universities, SSHs could easily collaborate within the same locality and that may cause higher possibility for students to decide to go to the college or university in the same town or prefecture. Further, it also implies that the SSHs in the rural area, if they could collaborate with the local college or university, could make the young scientists choose to remain in the same locality and contribute to the local development in the future.

Third, in the SSHs where the ratio of teachers participation to the SSH activities is high, or where the ratio of students participation in the SSH activities is high, so does the rate of graduates who advanced to higher education for science and technology major.

Fourth, contrary to their expectation, they have found the negative correlation between the extent to which the teachers actively adopted the content beyond the national education guidelines at the SSHs, and the ratio of graduates who advanced to national/prefectural/municipal colleges and universities to major in STI-related subjects. Kobayashi, et al. interprets that as the number of SSHs increased, the program has expanded the school coverage from a few high performing schools to many average performing schools and that the definition of "beyond the national education guidelines" may also vary between SSHs. Especially at the average performing SSHs, they might have been placing a higher priority on a performance indicator other than the college admission for science and technology major.

Fifth, there seems to be a trade-off between the time SSHs spend on the special activities such as the Project-Based Learning and field work, and the time they spend on the counselling with the students on the choice of university and the preparation for the entrance exams. This may also negatively affect the prospects for university admission for science and technology major.

Meanwhile, the JST (2016) also conducted the SSH survey for 201 schools in 2014, and found that 67 percent of the students responded positively to the question, "Has your desire to learn about science and technology increased due to the SSH program?" (p.101)

Sustainability of the Program Implementation

As the SSH designation is a fixed term, one question may easily arise: What would become of the SSH once it's back to a normal school status? The school will not be granted a special budget anymore. Therefore, the schools must be prepared for the graduation from the SSH status, and develop the mechanism to ensure the sustainability and continuity of the program implementation.

Once SSHs and universities built new partnerships, they could continue even after the first five years. Universities and research institutes did not ask for remuneration for their outreach program and high schools could invite guest lecturers without bearing the cost for the invitation.

SSHs also found their own way to secure the budget to continue the study tours in such a way as to disburse from the pooled fund for annual school excursion trips, and to apply for other government grant facilities.

Another possibility is that the latecomers may receive the SSH nomination, building on the earlier experience of the other SSHs in the same constituency. Dissemination to or knowledge exchange with neighbouring schools is one of the key elements of the program, and earlier SSHs could also benefit from the activities of the current SSHs.

In conclusion, the SSH program plays the catalytic role in creating the ecosystem of promoting STI study across the constituency, and each school finds the way to build on the earlier investment with the special budget for SSH and deliver the better science education in a sustainable manner.

Implications for Bhutan

If the Royal Government of Bhutan (RGOB) introduces a similar program, there are a few issues to consider. We must note that the institutional arrangement of the SSH program in Japan makes sense in the Japan-specific context.

First, SSHs must be aware that the good practices proven to be effective in the research and development activities in their schools should be scaled up by involving non-SSHs, junior high schools and elementary schools in the same constituency. The SSH is not the program to select and develop super elite schools or elite students in science, segregating elites from non-elites.

Second, the SSH program is a component of the more comprehensive policy framework in Japan that aims at enhancing the students' knowledge and skills by customizing the curriculum in accordance with the interest and aspiration of each student. Although science is highlighted in this paper, the whole policy framework has been designed to bring more flexibility into the delivery of education. Because of the temporary nature of the program with a fixed term, once their super science curriculum is developed and made sustainable, the SSHs may shift to the other programs that address the interest and aspiration of the other students. It doesn't aim at the permanent institutional arrangements that create schools specializing in specific subjects.

Third, the research and development activities at SSH require strong commitments from the teachers involved and may cause them extra workload, no matter if they are directly involved in science or not. In Japan, teachers have spent extra hours for science curriculum and extra-curricular works. What is required at the SSH program is the teachers' readiness and capacity to design new curriculum and activities. We must see how Bhutan is able to create such enabling environment at the target schools.

Fourth, the program has been backed by the heavy accumulation of universities, research institutes, and other schools that the SSHs are able to collaborate with in their neighbourhood. This geographical concentration is made possible in such a highly populated country as Japan. But we are not sure if there are such intellectual resources available in the same constituency for the premier schools in Bhutan.

Technical and vocational education and training (TVET) institutes are located in remote areas and they have potential to be a local collaborator to the premier schools. However, if we look at the TVET institutes as potential partners, we should consider transforming them from single-skill orientation to multi-skill orientation and strengthening their community outreach programs[8]. If the RGOB starts with a limited number of premier schools, nine colleges under the Royal University of Bhutan (RUB) could be their immediate partners. But if so, the site selection of premier schools with specialized subjects should be made in accordance with the accessibility to the colleges working on the relevant subjects.

Fifth, the SSH program has also been supported by thoughtful academia. They dedicatedly collaborated with school teachers and manage the classroom delivery and science experiments

by themselves. When they receive students at their home lab, they should also explain their research project in a language easy enough for students to understand. If we intend to introduce a similar program to Bhutan, we should also take a close look at the practices being made at colleges and research institutes which we expect to be a supporter of the premier schools. In other words, we must be concerned about higher education if we want to enhance secondary education.

Conclusion

The success of the SSH program at each school is primarily due to the self-help efforts of the school management and teachers, but it's also due to the enabling environment created by a variety of stakeholders. If we launch the Premier School program in Bhutan independently without due consideration of the capacity of each stakeholder surrounding the target schools, all the responsibilities for the enhancement of a specific subject may go to the shoulders of the school alone and a few group of teachers. They may be left at a loss wondering what to do.
The most important lesson from Japan's experience in SSH is that we should take a whole-of-the-community approach for each target school. In Bhutan, it is recommended that we start with a comprehensive capacity assessment of the stakeholders around the target premier schools, and work on capacity development of each. It also requires the whole-of-the-government approach for the effective program implementation, coordinating with the central stakeholders in the tertiary education and TVET.

The 12th Five Year Plan Guideline refers to coordination, consolidation and collaboration, as an overarching principle (RGOB. 2017). Once it is implemented in the most effective manner, the Premier School program will be a strong case of the Triple C exercise.

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1 Bhutan to establish science focused 'Premier School',The Bhutanese, 10August, 2016.

2 Premier School endorsed for excellence in education,The Bhutanese, 21 January, 2017.

3 Capacity development refers to the ongoing process of enhancing the problem-solving abilities of the country by taking into account all the factors at the individual, organizational, and societal levels. (JICA. 2006., p.2)

4 In Japan, new academic year starts in April.

5 The municipal boards of education are in charge of elementary and junior high schools.

6 We must note that the sample data were collected only for the students who advanced to the colleges and universities immediately after they completed Class 12.

7 ditto.

8 Yamada and Subba(2017)

About the Author

Koji Yamada is the Chief Representative, Japan International Cooperation Agency, Bhutan Office since April 2016. Before his appointment in Bhutan, he used to serve as Senior Advisor to Director General at the Operations Strategy Department, JICA HQs, and was a strong advocate for mainstreaming SDGs in JICA's development cooperation operations. Joining in JICA in 1993, he has served for various ODA operations mainly for South Asia and research projects at the JICA Research Institute. He has also worked as co-financing officer at the World Bank in 2000-2003. He is Visiting Professor on development studies at the Nihon Fukushi University, Japan. Email: yamada.koji@jica.go.jp

A Review on Management of Freshwater Resources

Yogeeta Dahal

Abstract

Freshwater resources and aquatic biodiversity are vulnerable to degradation in many ways including climate change, increased population, land use changes, development activities, contamination, and pollution. The Himalayan region including Bhutan has rich freshwater sources and support a wide range of freshwater biodiversity. Bhutan's unique concept of Gross National Happiness (GNH) gives equal importance to conservation and environmental protection in pursuit of development and happiness. This review paper discusses on our dependence on freshwater resources, the importance of the aquatic biodiversity, and identifies management approached that have been adopted over time. Further, the emerging issues that pose threat to the freshwater resources have been explored. It concludes with the need to research and study more on the freshwater biodiversity of Bhutan which is least explored and recorded. This is important for planners and decision makers, conservation, and sustainable management of resource to protect the rich aquatic biodiversity and valuable resource of our country.

Key words: *Aquatic biodiversity, Freshwater Resource Management, Macroinvertebrates, Climate Change, Environmental Assessment.*

Introduction

Freshwater, a valuable resource found abundant in the Himalayas, is available in different forms including lotic and lentic surface waters, riparian systems, and spring water. Freshwater habitats in Bhutan are scattered in the form of rivers, spring water, wetlands, lakes, glacier, man-made reservoirs, ponds and paddy fields (Bhattarai, 2006) supporting organisms belonging to different ecological zones. Freshwater is a critical habitat for 6% of all animal species and one-third of vertebrate species (Geist, 2011). It provides services in the form of scenic values, fisheries, water for irrigation and domestic use, fishing and other recreational activities (Maltby and Acreman, 2011).

Fish and fishery are one of the important services of the freshwater ecosystem. Freshwater fisheries differ from marine fisheries in terms of scale, function, and anthropogenic drivers. Freshwater fish are characterized with no or little tolerance to saline condition and require upstream and downstream movement for spawning and feeding sites (Winemiller, 1983; Silva et al., 2015).

Fisheries in the developing world are a means of livelihood and a source of socioeconomic values such as food and nutrition, employment opportunities, and recreation facilities (Rahman et al., 2016). Fishing and aquaculture support the livelihood of approximately 500 million people, especially those living in poverty in Africa and Asia (Un et al., 2015). Asian countries like China, India, Thailand and Bangladesh have rich fish diversity and the majority of the people depend on fishery for food and income (Murshed-e-Jahan et al., 2015; Rahman et al., 2016).

Bhutan currently has two established community fisheries: Berti capture fishery and Hara chhu community-based capture fishery (Ghimiray et al., 2015; Wang, 2014). The fishing community is defined as a community that is "substantially dependent or engaged in the harvest of fishery resources to meet social and economic needs" (Clay and Olson, 2008). The establishment of community fishery in Bhutan is relatively new and the potential of fishery production remains unexplored (Bhattarai, 2006). Fish conservation centre and hatchery for Golden Mahseer and other native fish have been installed at National Centre for Aquaculture, Gelephu, to conserve the endangered fish species Tor Putitora, Golden Mahseer, (Hamilton, 1822). Furthermore, to decrease the consumption pressure on the native freshwater fish, carp

farming is initiated to distribute fingerlings to fish farmers (Tamang, 2015; NCA).

Although fishing and aquaculture practices improve the livelihood, food security and income generation of fishing communities, some social, cultural and policy constraints still prevail. It was only after publishing the Millennium Ecosystem Assessment in 2005 (as cited in Durance et al., 2016) that more attention and value was directed towards the study and understanding the importance of freshwater ecosystem and its services. The conventional freshwater ecosystem management system which focuses on maximizing resource production ignores other important ecosystem factors like the interaction of predators and prey, habitat and biodiversity loss which are the fundamental feature that helps sustain the freshwater resources (Pitikch et al., 2004; Durance et al., 2016). Indicator of stress on freshwater resources is not limited to the aquatic ecology but expands to a wider horizon. Approximately 450 million people live under severe water scarcity and by 2050 it is expected to rise to 2.2 billion (Vorosmarty et al., 2000). Pressure on the freshwater resources is likely to rise with increasing development, population and climate change. Sharma et al. (2016) found out during the study of livelihood practices in Cambodia that those involved in direct natural resources extraction such as fishing or farming were more vulnerable to shock and poverty. Freshwater in urban areas of Bhutan is challenged to maintain its pristine state to support aquatic lives. New strategies and approaches are required to address such issues so that maximum benefit of freshwater resources is achieved (Murshed-e-Jahan et al., 2015).

Literature Review

Freshwater: a valuable resource

Freshwater is defined as the natural moving or still water sources like river, stream, lake or pond (Morris and Camino, 2011) which has less than 1,000 milligrams of dissolved salts per litre (Wilson et al., 1981). Freshwater sources provide season based small scale fishery with economic and nutritional values to fishing communities (Ficke et al., 2007; Khan et al., 2016). Fishing practices help eradicate poverty through food security, employment, and economic development. For instance, fish Garragotyla (Gray, 1830) although commercially minor, provides high consumption value as a source of protein for poverty ridden population in Nepal (Ranjan et al., 2005; IUCN, 2016). Developing countries in Asia like India, China, Vietnam, Cambodia, Philippines, and Bangladesh practice fishery in rivers, ponds, and cage aquaculture where fish is considered as an important part of the meal (Ficke et al., 2007; Alam et al., 2013). The abundant freshwater of Bhutan supports the rich biodiversity, and the nation economically benefits from hydropower energy and irrigation (Shrestha et al., 2015).

The Himalayan Region and Dependence on Freshwater

Freshwater resources fulfil our basic needs such as water for drinking, agriculture, and hygiene. Water availability has been identified as one of the principal pressures to the human development in the Bhutan (GNHC, 2011). Farmers practising subsistence agriculture in the mountainous terrain and deep valleys of Bhutan rely on monsoon rain for the cultivation of crops and rice. Unreliable water availability for irrigation is a common concern that Bhutanese farmers share as their income and livelihood depend on successful agricultural production (Kusters and Wangdi, 2013).

Freshwaters of Himalayan region have diverse freshwater fish (Goswammi et al., 2012; Gurung et al., 2013) but just enough to support subsistence and recreational fisheries providing limited option commercial fisheries (Petr and Swar, 2002). The Himalayan River attracts sports fishing and river bird watching. Catch and release practice provide a substantial inflow of income for the national economy through the increasing interest of international anglers (Gupta et al., 2015). Fish such as Brown trout, Salmo trutta (Linnaeus, 1758), Mahseer (Tor spp.) and

Copper Mahseer, Neolissocheilushexagonolepis (McClelland, 1839) are some of the preferred fish species for anglers in the Himalayan region (Petr and Swar, 2002; Gupta et al., 2015; IUCN, 2016). For sports fishery, fish species such as Snow trout, Schizothoraxnepalensis (Terashima, 1984) and Brown trout, Salmo trutta (Linnaeus, 1758) (introduced species) are preferred in some of the Himalayan Rivers (Petr and Swar, 2002).

Freshwater resources not only support the immediate community but also of downstream areas. It is estimated that 2.5 million fishery communities of India and 4 lakh fishery communities in Bangladesh rely on Himalayan Rivers for income and nutrition (Shrestha et al., 2015).

Integrated Water Resource Management

Water is the centre of all life forms and a necessity for our daily activities. Water resources are mobile flowing indiscriminately across landscapes becoming increasingly interconnected with social, political, environmental, and legal issues both at national and international level (Biswas, 2004). Thus making water resources management related decision a complex task. The concept of integrated water resources management (IWRM) is a holistic bottom up approach for sustainable management of water resources. It includes multidisciplinary development and management of water for equitable social and economic benefits without compromising the environmental sustainability (Khanna et al., 2016). A successful example of IWRM can be cited of that in Nepal where the community farmers participated for the management of irrigation system through the decision making at the local level (ibid). Similarly, IWRM approach in Bhutan was also a success with participation from local farmers on water availability issues and sharing the common resource in Lingmutey chhu community (Tyler, 2006). One of the mandates of Gross National Happiness (GNH) for Bhutan is to become self-reliant by eradicating poverty and bringing well-being through country's development in harmony with the environment. Hydropower development is such an example in Bhutan providing environmentally safe energy, economic support, and employment opportunities to people (Dorji, 2016). Utilizing natural resources through integrated manner for sustainable use is of national importance

Fishery Management Practices

New management strategies have been identified which emphasizes on the holistic approach towards freshwater resource management. It includes incorporating indigenous knowledge including social issues like local stakeholder activities, equal sharing of benefits among the stake holders, including issues related to maintaining environmental quality, and conservation of aquatic biodiversity (Done and Reichelt, 1998; Welcomme and Petr, 2004; Arlinghaus et al., 2016). An equally important aspect of sustainably managing the natural resources at the community level is by providing a sense of ownership and handing over the power to decide to the community. This is apparent in both the community fishery in Bhutan: Harachhu and Bertichhu. Harachhu capture fisheries management group, formed in 2010, aims to support the Harachhu fishing communities through sustainably use the freshwater resources through improving post-harvest processing and facilitating market for fish products (Ghimiray et al., 2015)

Cowx and Gerdeaux (2004) reported that traditional conservation method like captive breeding, designing and regulation of reserves and habitat was not effective. Rather a holistic approach is essential to address the issue, such as evaluating factors that govern and maintain the aquatic biodiversity and stability of the ecosystem process (Geist 2011; Durance et al., 2016). Use of banned and illegal fishing gears poses threats to the fish population by trapping juveniles and cause disturbance during spawning season (Rahman et al., 2016). Identifying the processes and elements that degrade the resource can help to maintain the integrity and sustain the resource. To protect and sustain the freshwater resources in Bhutan, practices

such as the use of small bamboo traps that harm the juvenile fish are forbidden and strict rules are enforced to avoid the capture of endangered fish species from the freshwater rivers.

Multidimensional Threat to Freshwater Resources

The Himalayan regions are characterised by low level of development and high exploitation of natural resources (Petr and Swar, 2002). Although the threat from over-exploitation is minimal in Bhutan (Thoni, 2013), climate change (glacial melt), rising economic development (dam construction, urban area expansion, land use changes), and the introduction of new species pose a multidimensional threat to the sustainability of freshwater resources. Additionally, population growth, changing lifestyle and increased food demand also pressure freshwater availability. Although freshwater is abundant in Bhutan (Dorji, 2016) the demand for freshwater availability is emerging issue due to pollution and contamination especially in population concentrated area and industrial areas (Giri and Singh, 2013).

Climate Change and Freshwater Sources

The Himalayan region is blessed with rich sources of fresh water from frozen glacier and snow. The Himalayan regions, with 54,252 number of glaciers (Bajracharya et al., 2015), are in immediate threat from (GLOF) glacial lake outburst flood (Bajracharya et al., 2007; Bates et al., 2008; Bajracharya and Mool, 2010; Shrestha et al., 2015) as mountain regions are sensitive to climate change. The glaciers of the Himalayan region are retreating, shrinking and thinning (Bajracharya et al., 2015) affecting the water quantity and timing of water availability (Rabatel et al., 2013). The Lunana glacier in Bhutan showed the highest loss of glacier during 2000-2010 (Bajracharya et al., 2015). In future, the impact of climate change on freshwater resources is likely to outweigh its benefits. These changes will affect the water dynamics and aquatic habitats such as lakes, wetlands and river systems. Sudden swelling up of water volume from glacial melt leads to flood and landslides followed by habitat loss of aquatic ecology, terrestrial animals, and inhabitants residing near the sources.

Awareness and disaster risk management such as Himalayan Climate Change Adaptation Programme (HICAP) facilitates to meet the challenges emerging in the Himalayan region (Shrestha et al., 2015). In Bhutan, awareness and disaster management have been employed to avoid the risks associated with GLOF (UNDP) for regions such as Punakha-Wangdi Valley and Chamkhar Valley, which are identified as regions under the threat of GLOF. A total of 25 glacial lakes in Bhutan have been identified as potential source of threat in the form of GLOF (Chhopel, 2014). Additionally, the Constitution of Bhutan declares to keep 60% of forest cover for all time to come and at present Bhutan has 70.2% of land under forest cover (GNHC, 2011). Bhutan also has three wetland locations as Ramsar sites in Bumdeling, Khotokha and Gangtey-Phobji (Banerjee and Bandopadhyay, 2016; Choden, 2016). Such actions towards protecting the environment and minimizing the impact of climate change to sustain the natural resources are important and need immediate attention to protect the rich biodiversity of the country.

Response to Change in Temperature

Climate change is an emerging issue that is taking the globe on the heated discussion to find a solution to solve the issues related to rise in temperature, variation in precipitation, and changing weather patterns (Ficke et al., 2007). However, there are some positive impacts of climate change, such as a rise in temperature bringing favourable condition for agriculture system in northern Europe (Olesen and Bindi, 2002) and places like Bumthang in Bhutan showing a shift towards increasing rice production owing slight increase in rainfall (Wangchuk and Siebert, 2013). Despite the positive impacts of climate change, the negative impacts on the ecosystem and the environment need more attention. Animals and plants have shown observable behavioural changes especially with the change in temperature and moisture

availability, such as early migration of birds and insects, and early flowering of trees (Burkett et al., 2005; Camille, 2006). In fishes, the rise in temperate can alter migration and spawning behaviour. Further, birds feeding on smaller fish will starve and have to migrate to new territory. Similarly, temperature also alters water property which is directly linked to the functioning of the aquatic ecosystem and the surrounding environment. The effects of climate change in the form of environmental degradation: the spread of diseases, natural calamities, and frequent severe floods have resulted in lack of good fish seeds and have caused economic losses in countries like Bangladesh (Jahan et al., 2015; Murshed-e-Jahan et al., 2015). Common carp, Cyprinuscarpio (Linnaeus, 1758), have been preferred over other fish in many countries worldwide for its character of being persistent and having high tolerance level to temperature and turbidity (Khan et al., 2016; IUCN, 2016).

The global temperature has increased by an average of 0.74 ^{0}C compared to past 100 years (Burkett et al., 2005; Pacifici et al., 2015) and by 2050 the average temperature of Hindu Kush-Himalayan region is expected to increase by an average of 1-2 ^{0}C (Shrestha et al., 2015). Global warming and temperature variation are resulting in extreme dry climate in one region while some regions are flooded. Signs of climate change are observed in the increased surface runoff, especially during spring and summer, and formation of lakes due to glacial/ice caps melt (Bates et al., 2008; Piao et al., 2010). Since 1960, the temperature of China has increased by 1.2 ^{0}C leading to heat waves and glacier retreat (Piao et al., 2010). Camille (2006) and Bates et al. (2008) report the effects of temperature change observed in shifting ecological boundaries, migration of species, and behavioural changes. The Northern Hemisphere is getting wetter with an average decrease of 7% frozen ground (Bates et al., 2008) and moving its boundary upward at an average of 6.1 m per decade (Camille, 2006). This means, with a shift in ecological boundaries, the biodiversity will also shift with changing climate and environment. When aquatic organisms are unable to adapt to these changes, they might as well get locally extinct. This will further cause a cascade of reaction in the food chain and affect organisms that are dependent on aquatic organisms for food such as terrestrial animals, birds, and humans.

Development Activities and Water Dynamics

Anthropogenic activities largely attribute towards the fluctuations of salinity, pathogen loads, and nutrients present in water (Bates et al., 2008). Freshwater resources have suffered from frequent intervention and disturbances (Cowx and Gerdeaux, 2004; Shrestha et al., 2015) making it the most threatened natural resources that need immediate attention (Durance et al., 2016). Discussed below are some of the developmental activities occurring at the cost freshwater resources.

Dam and Freshwater Environment

Damming of Bhutanese rivers is on the rise. Hydropower electricity is a source of cheap, safe, and clean energy as well as a source of water for agriculture and domestic needs (Ficke et al., 2007). Water for irrigation accounts for 70% from the total global water withdrawn worldwide (Bates et al., 2008) while agriculture accounts for 90% of water withdrawn from the Hindu Kush-Himalayan region (Shrestha et al, 2015). Nevertheless, developmental activities impact water resources and aquatic life through changes in water quantity and quality.

Dams affect the ecology of not only aquatic biodiversity but also disrupt the habitat of aquatic birds (Thoni, 2013) and terrestrial animals through deforestation and disturbances. Dam development impacts on three major environmental areas: water flow, fish migration, and sediment supply. This is evident in the construction of Sambor and Stung Treng mainstream dams in Cambodia which reduced inland fish supply affecting fish yield (Un et al., 2015). Dam reduces the fish spawning area and obstructs upstream and downstream movement ultimately reducing fish stock in the water body. This also negatively affects the target and non-target

species. The riparian ecosystems are also disturbed by flooding the area and altering upstream surroundings.

In Bhutan, almost 99% of the electricity comes from hydropower plants from Punatsangchhu, Mangdechhu, Wangchhu, and Drangmechhu river basins (Chhopel, 2014). Bhutan is economically dependent on hydropower generation and energy export. However, threats from global warming and irregular weather pattern may pose threat to the dam infrastructure and water ecology in the near future. Dam construction in Bhutan has lead to habitat loss of aquatic life, White-bellied heron, and negatively affected other organisms dependent directly and indirectly on freshwater resources.

Bhutan is a part of 23 important bird regions and home to 16 endangered bird species worldwide including White-bellied heron, Ardea insignis (Hume, 1878), Black-necked crane, Grus nigricollis (Przevalski, 1876), and Pallas Fish eagle, Haliaeetusleucoryphus (Pallas, 1771), to name some (Gillison, 2012; Banerjee and Bandopadhyay, 2016; Sharma et al., 2016). Water birds prefer rivers, streams, and wetland areas as their habitat. White-bellied heron primarily depends on fish as a major source of food (Pradhan, 2006; Lehikoinen et al., 2015). Constant disturbance to water bird habitat and feeding spots have been recorded through dam construction, setting fish traps, forest fire, fishing, and extracting sand and stones (Pradhan, 2006; Royal Society for Protection of Nature, 2007).

Land Use Changes and Agricultural Practices

Non-fishing activities such as changing land use practices and agricultural practices have an indirect effect on water sources and aquatic biodiversity (Petr and Swar, 2002; Bates et al., 2008; Arlinghaus et al., 2016). Increasing agricultural practices leads to leaching of excess nutrients into the water bodies (Jahan et al., 2015; Pacifici et al., 2015). The alteration of Europe's landscape into industrial scale agriculture and channelling water bodies for transportation had polluted streams and rivers with agrochemical pesticides and sewage surface runoffs (Hladyz et al., 2011). Pollution in Hindu Kush region has reduced the water quality and availability of cold water fishes (Petr and Swar, 2002; Gupta et al., 2015). The cost of recovering and purifying the contaminated water to its natural state is not only expensive but recovery of the native environment and local habitat to its original state is hardly possible.

Human's response to climate change through water diversion, water extraction, the introduction of new species, and pollution intensify the pressure on aquatic life (Ficke et al., 2007; Bates et al., 2008). Release or introduction of non-native species in rivers is a common practice while most are not successful. And if successful, the native species face negative consequences (Ficke et al., 2007; Arlinghaus et al., 2016; Khan et al., 2016). For instance, the introduction of brown trout in rivers of Bhutan decreased the cold water fish belonging to Balitoridae and Schizothorax spp. (Thoni, 2013). Introduction of common carp in rivers of Pakistan with the intention for food and income improvement reduced catches of local commercial fish species and altered habitat due to its vigorous reproductive potential and competition with native species for food (Khan et al., 2016).

Environmental Assessment Through Study of Aquatic Biodiversity

Environmental degradation emerged at large scale in the nineteenth century harming the aquatic ecosystems and human health (Friberg et al., 2011). Since then the focus on freshwater monitoring began with a focus on chemical analysis followed by bio-monitoring using bacteria, fungi and soon leapt to a holistic approach of taxonomic analysis of macrophytes, macroinvertebrates and fish (ibid). Biological diversity, environmental conditions, and health of water bodies are directly related to the sustainability of the freshwater resources (Mahender et al., 2016). River organisms regulate water quality by nutrient cycling, the breakdown of toxic substances, and energy transfer (Durance et al., 2016). The biotic communities act as remote

sensors over time and space and help in detecting environmental changes even when the stressors are inactive (Friberg et al., 2011).

Fish and macroinvertebrates are important freshwater organisms and indicator of water quality (Holmlund and Hammer, 1999; Giri and Singh, 2013; Dorji et al., 2014). They help maintain and regulate the food chain. Macroinvertebrates maintain the structure and function of freshwater ecosystem by nutrient cycling and are a source of food for fish (Zhang et al., 2014). Macroinvertebrates are used intensively in research for monitoring water quality from human activities, climate change, and land use modifications (Hartmann et al., 2005; Ofenbock et al., 2010; Friberg et al., 2011; Dorji et al., 2014; Zhang et al., 2014). However, due to limited scientific data on aquatic biodiversity particularly in Asia, the intensity of the impact of development on the rivers and aquatic biodiversity of the region has not been clearly studied (Dorji et al., 2014). For the decision makers, it is important to quantify the value of aquatic biodiversity and their contribution to sustainable management of freshwater resources (Durance et al., 2016).

Physicochemical Property of Water

Study of freshwater health and quality reveals the level of stress accumulated from the wide variety of activities. Chemical, physical, and biological components are important water quality parameters. Often in research studies, parameters such as the BOD (biological oxygen demand), COD (chemical oxygen demand), DO (dissolved oxygen), dissolved salts, and turbidity (transparency) are quantified to study the status of the water body of a region. These parameters are used to evaluate effects of intrinsic and extrinsic stressors like pollution and climate change (Burkett et al., 2005; Friberg et al., 2011). Lakes and rivers show observable physicochemical changes, such as decreased dissolved oxygen or increased pollution level, which is closely linked to aquatic species composition, species abundance, productivity, and physiology (Ficke et al., 2007; Bates et al., 2008). Biotic diversity combined with abiotic factors assist decision makers to identify the status of available resources, and manage the available resources in a sustainable manner.

Conclusion

Freshwater resources support the economy and livelihood of communities in Bhutan. Freshwater also supports a wide range of biodiversity directly and indirectly. A key challenge for natural resource managers is to sustainably manage the available freshwater resources. Threats to freshwater resources include climate change, increasing population, resource exploitation, pollution, and increasing food demand. In long term, the direct users of the natural resources are also at risk of being vulnerable to shock and poverty. For the sustainable management of the freshwater resource, a holistic approach with focus on multidisciplinary approach is developed. Therefore, more research addressed to understanding and recording the freshwater quality and its biodiversity in different eco regions of Bhutan is needed for conservation reasons. Bhutan is one of the biodiversity hot spots and it is crucial that we conserve the rich biodiversity of our nation.

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About the Author

Yogeeta Dahl is currently pursuing M Sc. in Natural Resources Management (second year) in College Natural Resources in Lobessa, Punakha. This research paper is a partial requirement for her Master's study. Her interest in research began in 2015 when she enrolled at the Asian University for Women for her B.SC in Environmental Sciences. Her interests are studying the impact on the environment from developmental activities

JOB SATISFACTION OF GOVERNMENT AND PRIVATE HSS TEACHERS IN THIMPHU THROMDE- A COMPARATIVE STUDY

Phurba Sonam Waiba

Abstract

Job satisfaction is one of the most widely discussed issues in organizational behaviour and management sciences. In this study, the level of job satisfaction among the private and government higher secondary school teachers was investigated using Hertzberg Two Factor theory. A total of 91 government and 92 private higher secondary school teachers, 183 teachers in total, working in six different government and private higher secondary schools in Thimphu Thromde were examined. The obtained data were analyzed based on the descriptive statistics using Statistical Package for Social Sciences Version 21. Independent sample t-test has been used in this study to analyze the job satisfaction level of government and private and male and female HSS teachers, and the mean scores of the six determinants by segregating it into extrinsic and intrinsic factors was also done. The study found that there is insignificant difference in the level of satisfaction between government and private, higher secondary school teachers and also male and female teachers. It also revealed that the respondents are satisfied with extrinsic factors and neutral with intrinsic factors. Hence Teachers are satisfied with Work and Working Condition, whereas Income and Policy and Management were the top determinants that caused dissatisfaction.

Keywords: *Job Satisfaction (JS), Thimphu Thromde, Government and Private HSS teachers*

Definition of Key Concepts

Thimphu Thromde: refers to a place which comprises of a major section of the population in the country, similar to districts but thromde is like town or city.
Government School refers to public schools owned by the state for the well-being of the people. It is fully funded by the state till grade X and upon meeting certain cut off point marks state will fund for further studies.
Private School: refers to non-state owned schools that will have private proprietors and owners in a business perspective and the students have to pay a fee for education.
Work: refers to the nature of teaching job, if it is challenging or not, whether depends upon individual's ability.
Working Conditions: refers to basic facilities and infrastructures like space, furniture, teaching learning materials and environment.
Self-esteem: Individual's evaluation of his/her own worth and potential.
Policy and Management: The policies in the organization governing them, supervisors and co-workers and roles entitled to them.

Introduction and Background

Teachers play a vital role in moulding and shaping the behavioural and intellectual capacity of the children. In fact, it is them who produces the leaders, managers and the nation driver in all times (Drukpa, 2010) so, the level of satisfaction of teachers towards their job is very important. "Teachers are behind quality human resource development", His Majesty the fifth Druk Gyalpo in his address to the teacher trainees rightly mentioned, His Majesty also asserted that teachers being the matter of paramount interest must cultivate a deep sense of awareness and commitment to building the nation.

Teaching is a very rewarding and satisfying profession when it comes to looking at positive students' progress. But on the other hand, it becomes frustrating and stressful when one has to

deal with huge class and larger teacher student ratio and top down management. The growing number of school could make teaching more challenging, as an increase in enrollment results in increased workload and management (Drukpa, 2010). Hence, it could lead to a shortage of teachers in the country and affect the quality of education (Ngimbudzi, 2009).

According to Drukpa (2010), teachers in Bhutan work for about 10 months a year and 8 hours a day (excluding time spent at home for correction, lesson plans etc.). Also, he stated that for domestic obligations and personal works they are entitled to just 10 days casual leave.

As of 2015 teacher attrition rate has been 2-3%, 198 in 2015. It has been found that 2010 had highest attrition rate with 5% and 2014 with 2%. Attrition of even one teacher has a huge impact on the education system and a waste of huge government resources in training and recruiting a new teacher (MoE, 2015).According to Hammond, (2011), the cost of teacher attrition is estimated at $ 15000 (Nu. 900000) at an average. So when 198 teachers resign, it would amount to about Nu. 178200000 yearly, which is, in fact, a wastage of huge chunk of government resource, which would have been used in other development activities otherwise.

So, with such a scenario, job satisfaction (JS) has been always questionable. Despite the fact that Bhutan has progressed its modern education system by leaps and bounds, there has always been a problem with retaining teachers. Thus, rethinking and reorganization are required. It is of paramount importance to verify and research upon what really causes all these? What could the government possibly do to improve this national concern? What can people do to make this profession prestigious and noble? And this study will study will provide a deeper insight as to what is the cause of all these? What is the job satisfaction level and where are the areas we have to improve or concentrate more on?

Despite the fact that Bhutan has progressed its modern education system by leaps and bounds yet, there are flaws where rethinking and reorganization are required. Hence government should study and see the level of job satisfaction in the country in teachers.And adopt necessary policies to attract and motivate teachers, institute promotions for further studies, provide a teacher friendly society and make the teaching profession more prestigious and attractive.

Literature Review

Job satisfaction is a very broad concept in every profession (Latif., Shahid., Sohil., & Shabaz., 2011). It can be defined as the perception of a person towards his or her job, the job-related activities and environment are job satisfaction (Raj & Lalita, 2013). Weiss, (2002), describe job satisfaction as a positive or negative judgement that an individual employee makes in the job. However, Ruggiero, (2005), stated that job satisfaction is multifaceted where he said that there could be satisfaction related to income, working environment, workloads, career progression and professional opportunities.

Also, Bishay, (2002), states that job satisfaction of teachers comes from the quality of teachers, performance and their skills and competence and they should be rewarded and recognised for their service. Teachers job satisfaction can be derived from both intrinsic and extrinsic factors some of the likely factors are student success, positive relationships with parents and society, personal growth and extrinsic factors are salary, benefits, holidays, rewards, recognition and working hours (Zembylas, 2006). And Sharma & Jyoti (2010), too asserted that the factors that are associated with teachers' job satisfaction are intrinsic, extrinsic and demographic factors.

Hence this study will try to seek a better understanding of the level of job satisfaction through intrinsic and extrinsic factors guided by Federick Hertzberg two factor theory, where the determinants were derived from various other literature. The conceptual framework has been adopted from the theory.

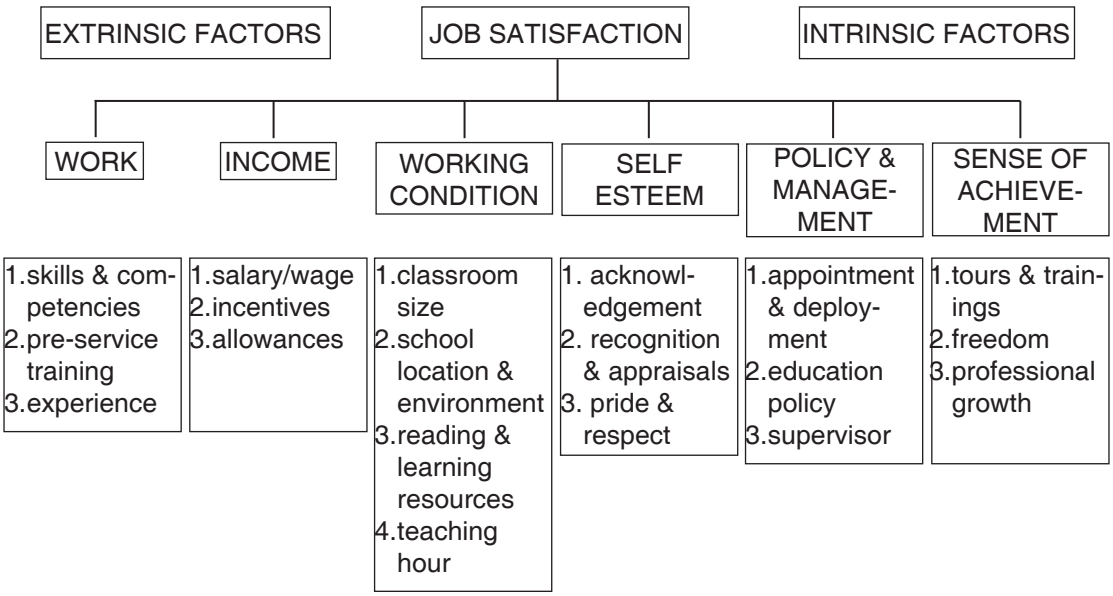
Hertzberg's two-factor theory has been widely examined in various job situations, and

though it has been considered non-traditional during its introduction in 1959, it has gained popularity and is most used and known theories for explaining motivation and job satisfaction.

According to Hertzberg two factor theory, "there are two distinct sets of factors for job satisfaction and job performance in organizations. One set labelled "satisfiers" or "motivators", which results in satisfaction when adequately fulfilled. The other set, labelled as "dissatisfiers" or "hygiene factors", which causes dissatisfaction when deficient", (Deshields, Kara, & Kaynak, 2005).

Intrinsic factors (motivators) are part of job content and are largely administered by the employee (teachers in this case). The extrinsic factors (hygiene factors) are under the control of the supervisor or someone other than the employee (principal, co-workers, students, parents, society in this case), (Deshields, Kara, & Kaynak, 2005).

In applying Hertzberg's theory to this study with slight modifications; intrinsic factors (motivators) are WORK, INCOME and WORKING CONDITION and extrinsic factors (hygiene factors) are SELF ESTEEM, POLICY AND MANAGEMENT and SENSE OF ACHIEVEMENT, which will be dependent variables measured through indicators (independent variables) as follows;



Research Questions

1. What is the level of job satisfaction of government and private HSS teachers in Thimphu thromde?
2. Is there any difference in the level of job satisfaction between government and private school teachers and male and female teachers?
3. What are some of the significant factors leading to satisfaction or dissatisfaction?

Research Objectives

1) To measure the overall level of job satisfaction of the govt. and private HSS teachers.
2) To undertake a comparative study between govt. and private school teachers regarding job satisfaction.
3) To undertake a comparative study between male and female teachers regarding job satisfaction.

4) To evaluate and examine the determinants of job satisfaction (extrinsic and intrinsic).

Methodology

The study is based on quantitative analysis, which is more of descriptive and explorative in nature. The study is a sample study so data was collected through randomly distributed semi-structured questionnaires. The study used a Likert-type scale to collect and measure each variable of the study.

The questionnaire is a modified semi-structured questionnaire developed from the theoretical framework assisted by Hertzberg two factor theory, where the six determinants were divided into six parts as; Work (W), Income (I), Working Condition (WC) and Self Esteem (SE), Policy and Management (PM) and Sense of Achievement (SA), and questions related to these determinants were collected from other researchers and used with modifications accordingly. The questionnaire is divided into two parts as follows;

Part A: it contains the general information of the respondents addressing its demographic details such as; nationality, gender, age, teaching hours and school type.

Part B: it contains independent variables (indicators) of the job satisfaction addressing the six core dependent (determinants) variables such as Work, Income, Working Condition and Self Esteem, Policy and Management and Sense of Achievement. The job satisfaction will be measured through five points Likert scale which will identify the different level of job satisfaction.

Table I. Measurement scale of satisfaction level.

Satisfaction Level	Scores
Highly Satisfied	5
Satisfied	4
Do not know/Neutral	3
Dissatisfied	2
Highly dissatisfied	1

The level of satisfaction is considered from score of the answers and was classified into 5 levels to the Best's criteria (1977), (as cited in Dutta, Barman, & Behera, (2014) as follows;

High Score – Low Score/Number of Levels, i.e, 5-1/5 = 4/5 = 0.8

Table II. Criteria for understanding the means of satisfaction level.

Mean Scores	Satisfaction Level
4.21-5	Highly Satisfied
3.41-4.20	Satisfied
2.61-3.40	Do not know/Neutral
1.81-2.60	Dissatisfied
1-1.8	Highly dissatisfied

Study Population and Sampling

Table III. Details of the study population and population size.

Name of School	Level	Type	Teachers
Dechencholing	HSS	Govt.	85

Motithang	HSS	Govt.	55
Yangchenphug	HSS	Govt.	64
Kelki	HSS	Pvt.	36
Nima	HSS	Pvt.	44
Pelkhil	HSS	Pvt.	12
Rinchen	HSS	Pvt.	40
Total			**336**

A sample size of 183 was calculated using Taro Yamane (1967) formula for the study. The formula was used since it was convenient to consider a good number of respondents from the sample population of 336.

Data Analysis Methods-Statistical Planning

Empirical analysis was done through descriptive statistics to describe mean and frequency of all the determinants and derived average satisfaction level of each determinant and later calculated the total average of all six determinants to find the overall job satisfaction level with the concept given below;

$$JS = W+I+WC\ (extrinsic) + SE+PM+SA\ (intrinsic)\ /6$$

(where; JS-job satisfaction; W-work; I-income; WC-working condition; SE-self-esteem; PM-policy and management; SA-sense of achievement)

Results

Personal and Job characteristics of the sample - The job and personal characteristics after analysis in terms of frequency and percentage showed that the total of 183 respondents were there of which 53% (97) were male and 47% (86) were the female teachers, 89.60% (164) were Bhutanese and 10.40% (19) were Non-Bhutanese. Also, it was found that majority of the teachers have teaching hours with 76.30% (135) of 5-7 hours per day. And equally half of the respondents with 50.3% (92) were government HSS teachers and 49.3% (91) were private HSS teachers. As per the literature it has been said that demographic is also an important aspect of the study but since Hertzberg two factor theory is applied here, the demographic factors would fit into either intrinsic or extrinsic factors (like gender, marital status would fit to intrinsic, teaching hours would fit to work load and school type would fit to working condition or environment), hence it has not been felt important reflect separately.

Overall satisfaction of all sample together -

TableIV. The overall level of HSS Teacher's Satisfaction.

		n=183
Questions	**Mean**	**Std. Deviation**
W1 (WORK)	3.66	0.94
W2	3.98	0.95
W3	4.07	0.92
W4	3.16	1.15
I1 (INCOME)	2.93	1.17
I2	2.92	1.15
I3	3.12	0.98
WC1 (WORKING CONDITION)	3.51	1.04

WC2	3.19	1.08
WC3	3.66	1.03
WC4	3.52	1.08
WC5	3.98	1.00
SE1 (SELF ESTEEM)	3.60	1.05
SE2	3.44	1.08
SE3	2.94	1.34
SE4	2.98	1.32
PM1 (POLICY & MANAGEMENT)	3.10	1.12
PM2	2.90	1.10
PM3	2.96	1.07
SA1 (SENSE OF ACHIEVEMENT)	2.96	1.09
SA2	2.92	1.12
SA3	3.31	1.09
SA4	3.12	1.08
Total	75.94	24.91
Average	**3.30**	**1.08**

**(4.21-5-Highly Satisfied), (3.41-4.20-Satisfied), (2.61-3.40-Neutral), (1.81-2.60-Dissatisfied) and (1-1.80-Highly Dissatisfied).*

The mean value for overall job satisfaction of teachers is 3.30 with a standard deviation of 1.08 which indicates that the satisfaction level of the majority of teachers is Neutral which in other words means that they are neither satisfied nor dissatisfied with the determinants used in the study.

Comparison of satisfaction level of Government and Private HSS teachers - Table V. Significance of difference between a mean score of various dimensions of job satisfaction for Govt. and Pvt. HSS teachers.

Dimensions of Job Satisfaction	**Govt. n=91**	**Pvt. N=92**
Work (W1-W4)	3.72	3.70
Income (I1-I3)	2.81	3.16
Working Condition (WC1-WC5)	3.38	3.77
Self Esteem (SE1-SE4)	2.99	3.50
Policy & Management (PM1-PM3)	2.83	3.14
Sense of Achievement (SA1-SA4)	2.86	3.30
W+I+WC+SE+PM+SE/6=J.S	3.14 (neutral)	3.47 (satisfied)

**(4.21-5-Highly Satisfied), (3.41-4.20-Satisfied), (2.61-3.40-Neutral), (1.81-2.60-Dissatisfied) and (1-1.80-Highly Dissatisfied).*

Statement	**Govt. N=91**		**Pvt. N=92**		**Sig. Value of t-test**
	MEAN	S.D	MEAN	S.D	
Average	**3.14**	**1.09**	**3.47**	**1.03**	**0.29**

Table V shows that private HSS teachers are Satisfied (3.47) and government HSS teachers are Neutral (3.14).Looking at individual determinants Working Condition has been found to be the most influencing factor for their satisfaction and the least by Policy & Management.

Likewise, for government HSS teachers, Work is found to be the leading factor to motivate them but Income has been a hygiene factor. Having said that, the overall mean average depicts that there is no significant difference in the satisfaction level of government & private HSSteachers as significant value of t-test (average) is greater than 0.05 (0.29>0.05) at (95% confidence level).

Comparison of satisfaction level of male and female HSS teachers - Table VI. The significance of the difference between a mean score of various dimensions of job satisfaction for Male and Female HSS teachers.

Dimensions of Job Satisfaction	**Male n=87**	**Female n=73**
Work (W1-W4)	3.79	3.64
Income (I1-I3)	2.96	3.02
Working Condition (WC1-WC5)	3.55	3.60
Self Esteem (SE1-SE4)	3.23	3.26
Policy & Management (PM1-PM3)	2.95	3.04
Sense of Achievement (SA1-SA4)	3.05	3.11
W+I+WC+SE+PM+SE/6=J.S	3.29 (neutral)	3.31 (neutral)

**(4.21-5-Highly Satisfied), (3.41-4.20-Satisfied), (2.61-3.40-Neutral), (1.81-2.60-Dissatisfied) and (1-1.80-Highly Dissatisfied).*

Statement	**Male n=97**		**Female n=86**		**Sig. Value of t-test**
	MEAN	S.D	MEAN	S.D	
Average	**3.29**	**1.10**	**3.31**	**1.06**	**0.43**

Table VI, shows that female HSS teachers have the mean of (3.31) and males have (3.29), but both male and female are Neutral.

Having said that, the results also depicts that, Work has been found to be the top motivating factor and Policy & Management the hygiene factor for both male and female HSS teachers. And it did not come as a surprise to find, the insignificant difference in the satisfaction level of male and female government & private HSS teachers as significant value of t-test (average) is greater than 0.05 (0.43>0.05) at (95% confidence level).

Table. VII. Comparison of mean score for each determinant segregated into extrinsic and intrinsic factors for the overall sample.

Dimensions of JS	**Mean Score**	**Satisfaction Level**
Work (W)	*3.71*	*Satisfied*
Income (I)	*2.98*	*Neutral*
Working Condition (WC)	*3.57*	*Satisfied*
Extrinsic Factors (W+I+WC)	**3.42**	**Satisfied**
Self Esteem (SE)	*3.24*	*Neutral*
Policy and Management (PM)	*2.98*	*Neutral*
Sense of Achievement (SA)	*3.00*	*Neutral*
Intrinsic Factors (SE+PM+SA)	**3.07**	**Neutral**

Table VII, clearly shows the differences in mean scores of each determinant, also it can be understood that the teachers in government and private HSS in Thimphu Thromde irrespective of male and female and other demographic factors, Work (3.71) is the top factor which has been helping them be motivated and energised in their schools, it is followed by Working Condition (3.57). It can also be deduced that the demotivating factor or the hygiene factor that could have caused dissatisfaction in them are Policy & Management (2.98) of the schools and government, it is then followed by Income (2.98).

Looking through the lens of Hertzberg two factor theory, the teachers in HSS in Thimphu Thromde (govt. & pvt., male & female) are satisfied in the factors that are Extrinsic in nature whereas, they are neither satisfied nor dissatisfied with the factors that are Intrinsic in nature.

Discussion

According to the results the overall satisfaction level of the teachers in government and private HSS teachers in Thimphu Thromde is Neutral which, means that they are neither satisfied nor dissatisfied but when government and private HSS teachers were compared using the mean scores it has been found that the private school teachers are satisfied and government school teachers are neutral despite the fact that there is insignificant difference between the two. Further, to see the cause of the difference in government and private schools each determinant was compared and it has been found that government school teachers lack satisfaction due to Income, Self-esteem, Policy and Management and Sense of Achievement whereas the private school teachers are better motivated in the aforementioned determinants above. As stated in the literature, usually in same position level of a civil servant when teachers have to work more and extensively and the other civil servant has light works and they are paid the same this could have impacted the motivation of teachers.

Also on the matter concerning Self-Esteem and Sense of Achievement, there is no better option than to appraise the hard work and dedication of the teachers, although there are many incidences of teachers being rewarded annually there should also be a way to let them feel proud of being teachers. Stigmatization of teaching as a profession could be one, and societal blame on teachers if their children do not do well in exams.

One of the most common hurdles in bureaucracy is policy and management and the role held by the supervisors are gigantic. Generally, the employees are subjected to top down management which would demotivate them.

Male and female teachers were also compared to see what the status of satisfaction would be between the two, and as per the result generated it is clear that both male and female teachers are neither satisfied nor dissatisfied, and there is an insignificant difference. Similar to the above analysis, the determinants were compared for male and female teachers. Coming to male teachers; Income and Policy and Management have been found to have affected their satisfaction likewise, female teachers are more or less good with all the determinants except for Income and Policy and Management.

Based on the final analysis the concluding remark would firstly be Income and Policy and Management are the factors that mostly affects satisfaction of teachers, secondly, it is understood that intrinsic factors seem to be affecting the satisfaction of the teachers. Hence the following recommendations could be made based on the findings of the study;

1. To make government and private schools teachers equally motivated, the pay and wage level of the teachers in government schools should be revised.
2. Making teaching as a profession prestigious by rewarding and stopping stigma by the society.
3. Enhance collaborative management and division of labour, under the umbrella of a common and approachable manager.

4. Look into personal challenges and hurdles of the teachers to understand their intrinsic deadlock.
5. Mindfulness and Meditation training or courses that could reduce their stress and be at peace intrinsically should be initiated.

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About the Author

Phurba Sonam Waiba, is a Program Officer at Human Resources and Skills Development Division (HRSDD), Ministry of Labour and Human Resources (MoLHR), Thimphu; holds Post Graduate Diploma in Public Administration (PGDPA) from Royal Institute of Management (RIM), Semtokha Bhutan and under gradation from Sherubtse College, Kanglung Bhutan with Bachelors of Science in Life Sciences. His areas of research include Ethno-botany, Palynology, Public Health and Medicine and his research interest include Biological researches (plant science) and Educational researches such as understanding post-graduation outcome and experience, Youth and Employment and Entrepreneurship perceptions of youth and graduates in the country.

Short Communication
First report of the ectoparasitoid wasp of genus Leucospis(Hymenoptera: Chalcidoidea: Leucospidae) from Bhutan

Tshering Nidup[5], Wim Klein[6] and Phurpa Dorji[7]

Abstract

The field survey of 2014-2016 revealed two species of rare ectoparasitoid wasp from the genus Leucospis, LeucospishistrioMaindron, 1878 and L. Japonica Walker 1871 in Bhutan for the first time. This group of wasp survive as an ectoparasite on solitary bees and wasps through special mimicking colours and sucking out the body juices of host larva thereby killing it. This report indicates the gross underestimate of the leucospid species found in Bhutan and warrant supplementary documentation in future.

Keywords: *Leucospidae, Leucospis, ectoparasite, wasp, Bhutan*

Introduction

This group of wasp are rare and found in places where hosts are abundant. They develop in the nests of solitary bees and very rarely in wasps. They survive as ectoparasitiods through typical mimicking colours (BoučekandNarendran, 1981; Kumar and Sureshan, 2016; Ye, Achterberg, Yue and Xu, 2017).Host larvae are killed by sucking our body juice and like L. japonica parasitoids on large Megachilidae species that is an efficient pollinator, thereby risking the disruption of pollination biology (Staab et al., 2016).Globally 115 species are known from the cosmopolitan genus Leucospis Fabricius however,27 species were reported from Oriental realm (Penna, 2008; Kumar and Sureshan, 2016). Although 13 species were reported from Indian subcontinent only 7 species were reported from India (Bouček and Narendran, 1981; Brues, 1925; Mani, 1935, 1936). This report two species from the genus Leucospis for the first time from various places in Bhutan. This clearly indicates the gross underestimate of the species found in Bhutan.

Material and methods

Specimens were collected using insect nets. Specimens were killed with ethyl acetate in the closed container and pinned with the specific pin size of 0.00. Specimens were dried and stored in the insect box for the future reference and deposited in National Biodiversity Centre (NBC), Serbithang, Thimphu. All the regulations and acts of the Royal Government of Bhutan (RGoB) were followed during the field work in Bhutan. The identification was according to the Bouček & Narendran (1981), Brues (1925), Mani, (1935 & 1936), Kumar & Sureshan (2016), Ye et al., (2017). Color descriptions are provided to the specific sex available for this study.

Taxonomic account

LeucospishistrioMaindron, 1878 (Image: 1)
Descriptions: Male: Body mainly black with yellow markings. Yellow parts: antennal scape

5 School of Life Sciences, Sherubtse College, Royal University of Bhutan, Trashigang, Bhutan. Email: tsheringnidup.sc@sherubtse.edu.bt, B-Mobile No.: +975-1734855
6 Honorary Research Associate, Naturalis Biodiversity Centre, 2300 RA Leiden, Netherlands. Email: klein.wim.f@gmail.com
7 School of Life Sciences, Sherubtse College, Royal University of Bhutan, Trashigang, Bhutan. Email: phurpa.sc@sherubtse.edu.bt, B-Mobile No.: +975-17277779

ventrally, front vertex with two arc shaped spots, pronotum with posterior and anterior stripes, base of tegula on mesonotum, fore femur apically, stripe on fore tibia, spot on metapleuron, hind coxa baso-dorsally, hind femur from base crossing to entire dorsal border, and a spot sub-ventrally scutellum apically, T1,T4, T5 and T6 apically, on T6 reduced to spot.Measurement:7.17 mm.

Materials examined: 4.viii.2016, 1 male, Rinchending, Chhukha (26^{0}51'0.72"N & 89^{0}23'44.88"E, 405m), coll. Tshering Nidup & Wim Klein.
Distribution: India, Nepal, Japan, China (Bouček and Narendran, 1981; Ye, Achterberg, Yue and Xu, 2017).
Leucospis japonica Walker1871 (Image: 2 & 3)

Diagnosis: Female: Body mainly black with orange maculation. Orange parts: antennal scape ventrally, pronotum anteriorly (highly reduced) and posteriorly, mesoscutum pale stripe posterior-laterally at the base of tegula, hind femur with sub-basal lunate mark, from base crossing to dorsal border,T1 with a pair of large spots laterad of ovipositorial furrow, T5 with broad band posteriorly, epipygium with a pair of spots postero-laterally,scutellum posteriorly, tarsi reddish-brown, hind coxa baso-dorsally. Ovipositor sheath reaches propodeum.Male: similar to female colourations but differs in following ways: hind femur with basal orange mark usually separated from the apical mark, T4 with orange transverse band posteriorly and broader than the band on T5,epipygium black.Measurement: 3 female: 8.68-12.92 mm; 1 male: 8.23 mm.

Material examined: 12.viii.2016, 2 female, Wachey, WangdiPhodrang (27^{0}36'06" N & 89^0 52'28"E, 1506m), coll. Tshering Nidup & Wim Klein; 6.viii.2016, 1 female, Mabisa, Chhukha (27^{0}04'09" N & 89^{0}33'37"E, 1799m), coll. Tshering Nidup & Wim Klein.
Distribution: India, Bangladesh, Sri Lanka, Solomon Island, Philippines, China (Bouček and Narendran, 1981; Ye et al., 2017).

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About the Authors

Tshering Nidup is Lecturer in Sherubtse College, Royal University of Bhutan. He acquired BSc Life Science from Delhi University and MSc Ecology from Prince of Songkla University, Thailand. Research interest includes insect and amphibian taxonomy and conservation in Bhutan. In university, he teaches animal taxonomy and ecology.

Wim Klein is a retired entomologist working as an honorary research associate for the Dutch Biodiversity Center Naturalis in Leiden, coordinator for Digger wasps at EIS (The Dutch Expertise Centre for Insects) and conservator wasps & bees for the Natuurmuseum Brabant in Tilburg. Published several books and articles on the Digger wasps of the Netherlands, Belgium and Luxembourg. Currently working on the Digger wasp fauna of Bhutan and on a revision of the Dutch Digger wasp fauna.

Phurpa Dorji is a Lecturer at Sherubtse College, RUB. He completed BSc Life Science from Delhi University and MSc Biotechnology from India. His interest includes in biotechnology, Cicadidae and wasp fauna of Bhutan.

Image 1: Leucospishistrio: Body profile(male) with broken antenna

Image2: Leucospis japonica: Body profile (female)

Image3: Leucospis japonica: Body profile (male)