Impact study of SMART TV and SAMRT Classroom on the academic performance of students at Rangjung PS, under Trashigang.

Abstract

Bhutanese classrooms have undergone an unprecedented change in the recent years. Advancements in information communication technology and the internet of things have changed classrooms from traditional classrooms to smart classrooms. Using the terminal marks of class 6 and class 5 students in lower classes, this research investigated if there were significant differences in students' performance, across the terms and across the grades. The mid-term and annual examination marks of 32 class 5 students when studying in class 4, and the marks of 33 class 6 students when they were in class 4 and class 5 and students' demographic details were used as the primary data. The research found that the academic performance of class 5 students in term 1 and term 2 examinations in class 4 decreased significantly in some of the subjects. However, the marks of class 6 students as they progressed from class 4 to class 5 revealed significant improvements in their performance. In addition, there were no significant differences in the academic performance of the students, between terms and across grades, when disaggregated by family's socio-economic status. Recommendations and directions for future research are provided.

1. Introduction

The school has set up the special classroom called SMART classroom. The classroom is basically set up to uplift the academic learning with modern amenities such as SMART TV, Projector and computer set, so, the study aims to see the impact of such classroom for the academic learning of students as well as for teachers.

Advancements in information communication technology (ICT) and the internet of things (IoT) have proliferated classrooms. Based on the premise that ICT and IoT enhances classroom interactions between the teacher and the students and results in better academic outcomes in the latter (Hur, et al., 2016; Inan & Lowther, 2010; Moersch, 1995;Uslu &Usluel, 2019), smart classrooms have become a norm in today's educational establishments. Smart classroom is also synonymously called as intelligent classroom, future classroom, or technology-enhanced classroom (Zhang, et al., 2020), and the terminology is used interchangeably in this paper. Scholars have attempted to define smart classroom in various ways, but due to rapid developments in ICT and IOT a consensus have not been reached (Zhang, et. al., 2020). For example, in the initial stages corresponding to the 2001 to 2007 period, Uskov, et al., (2015) described a smart classroom as a learning environment characterized by a traditional face-to-face learning with technological enhancements of the Internet and a central viewing screen. The second generation (2008 to present) definitions of smart classrooms "is mainly based on active use of mobile technology, user/student/learner mobile devices and automatic communications between then and smart classroom environment" (Uskov, et al., 2015, p. 5). The current definition entails the use of ICT and IOT to facilitate greater student learning, with the incorporation of learning analytics. Chin (1999) described smart or intelligent classroom as an environment based on the applications of ICT, is learner-centered, which can be adapted to learners' different learning styles and learning abilities, and provide support for lifelong learning and ongoing development. Despite the variations in the definitions, it can be surmised that smart classrooms use ICT to enhance student learning.

Technological proliferation in Bhutanese schools is happening at a rapid pace, since the implementation of *i-Sherig* master plan (Ministry of Education [MoE], 2014). The master plan, spanning a period from 2014 to 2108, was developed around three core themes: iAble Thrust, iBuild Thrust, and iConnect Thrust. iAble includes several projects to enhance the capabilities and competencies of teacher educators, teachers, and learners. iBuild entails projects to strengthen ICT integration into curriculum, pedagogy, and assessment. iConnect consists of projects to enhance nationwide education and learning ICT infrastructure and system (MoE, 2014). The Ministry of Education and Skills Development is currently implementing i-Sherig 2 as well as Education ICT Flagship programme. The numerous ICT related projects have placed renewed emphasis on creating the infrastructure necessary for digitalising schools. The Ministry had procured and distributed 15280 computers to 567 public schools as of 2020 (MoE, 2021). During the same reporting period, the student computer ratio in public schools was 1:11, and that of the private schools was 1:12. Besides the computers, Internet connectivity and access has also been enhanced (MoE, 2021) along with the procurement and supply of projectors.

1.1. The research setting

Smart classroom is a technology-based learning that is proposed as a solution to increase the capabilities of students' academic. This method of teaching and learning make the education system more attractive and interactive, in addition to help educators to develop an engaging session.

The research was conducted in a primary school in Trashigang District in Bhutan. The school has a number of computers that are accessible to both the students and the teachers. A resource room equipped with a smartboard, smart television set, a projector all connected via a Wi-Fi Internet is available, which is used by different grades according to the schedule developed. From classes 4 to class 6, each classroom is equipped with a smart television set and a fixed projector, connected via the Wi-Fi. Teachers use these facilities to plan and deliver their instructions. These facilities enable teachers to use a multitude of classroom instruction modalities; videos, Power-Point slides, animations, and blended learning models of instructions, which are models that reconcile a component of online- or digitalbasedlearning with face-to-face supervision and instruction at school settings (cf., Buckingham, 2013; Cheung & Slavin, 2011).However, these facilities have not yet been harnessed to cater to students' learning analytics.Learning analytics refers to the collection and analysis of learning process data to better understand and improve learning (Aguilar, et al., 2017). During the time of this research, mobile phones and tablets of any make and design are banned in Bhutanese classrooms (Dhendup &Sherub, 2023). Therefore, it can be concluded that Bhutanese smart classroom is ahead of the first generation while simultaneously being at the infancy of the second generation of smart classrooms (Uskov, et al., 2015).

In accordance with the provisions in the i-Sherig Master Plan 1 and 2, ICT teachers have been trained to harness the potentials of ICT in teaching and learning (Embassy of India in Bhutan, 2021; Lhamo, 2021). The first ever national school curriculum conference 2016 recommended that ICT be incorporated in the curriculum (Royal Education Council, 2018). Since then, the curriculum is also infused with activities and learning tasks which enables teachers to access online materials with links provided in the textbooks. For example, the science curriculum framework for class PP to XII "encourages the integration of ICT as an integral part of the science teaching strategy" as a means of effective pedagogy (Department of Curriculum and Professional Development [DCPD], 2022, p. xxiii). In addition, one of the goals of science education, according to DCPD (2022) is to use, develop, and apply ICT skills in augmenting science and engineering practices. ICT therefore is not just perceived as a teaching strategy in Bhutan, but also as a goal of education.

1.2. Research objectives and hypothesis

The objectiveof this research is to empirically demonstrate if there is significant gain in student achievement as a result of the implementation of smart classroom. In addition to determining the effectiveness of smart classroom, this research also attempted to find out in which subject was the most significant gains registered. The research hypothesis guiding this research are as follows:

1. There are significant differences between the academic performance in STEM subjects, across the terms and grades.
2. There are significant differences between the academic performance in language subjects, across the terms and grades.
3. There aresignificant differences between the academic performance in arts subjects, across the terms and grades.
4. There are significant differences between the academic performance based on parent's educational and occupational status.

2. Literature review

The use of ICT to create smart classroom and facilitate greater learning among the students is grounded in the constructivists' paradigm of education. One of the central tenets of constructivism is that learners actively construct meaning of the experiences that they encounter. Based on this philosophical underpinning, it can be surmised that students develop their own subjective meanings of their educational experiences (Duffy & Jonassen, 1992; Tan, et al., 2006). A direct implication of constructivist's school of thought on classroom instruction is the emphasis on student-centered instructions (Jones, et al., 1994). Smart classroom facilitates student-centered classroom instruction in several ways leading to greater academic achievements, as discussed in the following sections;

2.1. Creating smart learning environments (SLE)

There are numerous conceptualizations and models of SLEs. On a fundamental note, a SLE is a technology enriched classroom facilitating face-to-face or online interactions. Hoel and Mason (2018) reviewed all the frameworks of SLE against the standards developed by IT standardization for learning, education and training (ITLET) within the International Organization for Standardization (ISO), and concluded that the conceptual model developed by Koper (2014) was an adequate framework. A schematic representation of Koper's model is provided in Figure 1. The following are the model's components: A Learning Instance is a unit of learning that has triggered the primary activities represented in learning, which are accessible through Human Leaning Interface (HLIs), and is the key element to be observed in an SLE system. The Physical Environment and other contextual influence variables are used to instantiate the Learning Instance, such as when a teacher specifies a task, organizes an event, establishes goals, and so on; when the instructor makes interventions that require the use of digital devices.To learn, the learner must first identify the situation (task, learning goals, schedule, etc.); then the learner must interact with other learners, either directly or indirectly; then the learner must create outputs to externalize learning achievements; and finally, the learner must perform meta-activities through Practicing and Reflection. Each activity of a learning instance is monitored by SLE system sensors, and the observations are relayed back to a

Context-awareness & Adaptiveness engine, which adjusts the input factors for the next learning instantiation. Consequently, Koper (2014) defines SLE as

> SLEs are physical environments that are improved to promote better and faster learning by enriching the environment with context-aware and adaptive digital devices that, together with the existing constituents of the physical environment, provide the situations, events, interventions and observations needed to stimulate a person to learn to know and deal with situations (identification), to socialize with the group, to create artefacts, and to practice and reflect (p. 14)

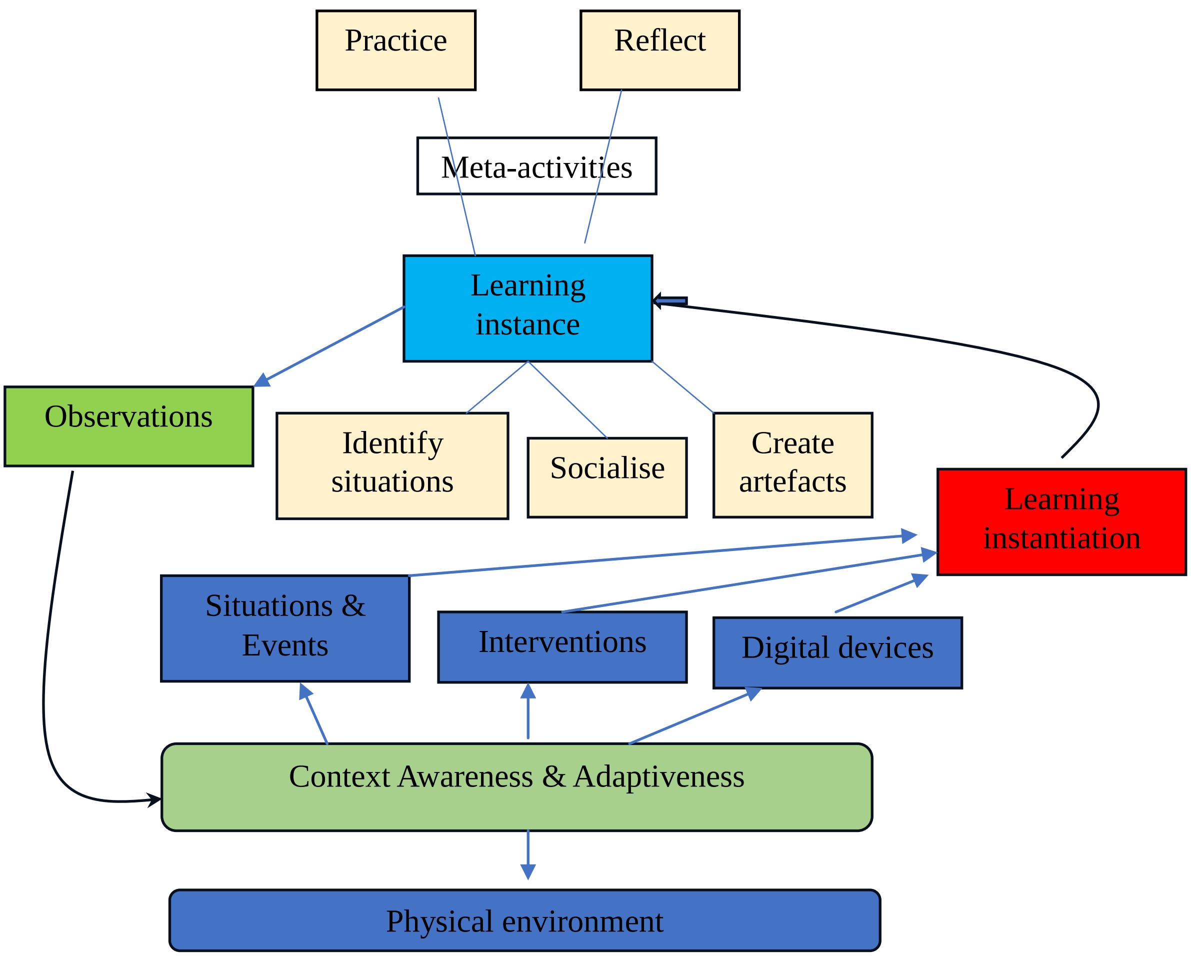

Fig 1. SLE core reference model (Adapter from Koper, 2014).

However, the SLE in Bhutanese schools appears to not have reached the levels proposed by Koper (2014). First because there is little usage of cameras to feed data for emotion analysis, and no complex software is used to analyse the data collected.

Spector (2014) asserts that a SLE should fulfil three criteria: effective, efficient, and engaging. Elaborating on the previous writing, Spector (2016) states that SLE should have five characteristics; (1) knowledge - access to adequate information and the ability to add or modify that information, (2) task support – the ability to perform a task or provide a learner with tools and information needed toperform a task; (3) learner sensitivity – the ability to maintain and make use of a profile of the learner so as to provideappropriate support and knowledge; (4) context sensitivity – the ability to recognize specific situations, including those situations in which alearner might be in need of assistance; (5) reflection and feedback – the ability to critique a solution or performance and/or provide meaningful andtimely feedback to a learner based on the learner's progress and profile and the learning task at hand.A SLE aims to provide learners with authentic tasks, opportunities for individualized and group learning, on time assessment and feedback so that it positively affects their achievement.

2.2. Pedagogical implications

Since the 1990s, constructivism has emerged as a dominant epistemology, replacing the objectivist and positivists paradigm in education (Tan, et al., 2006). One of the central tenets of constructivism is that learners actively construct meaning of the experiences that they encounter. Based on this philosophical underpinning, it can be surmised that students develop their own subjective meanings of their educational experiences (Duffy &Jonassen, 1992). Simultaneously, the world has advanced further from technological age to knowledge age or the innovation-driven age. To keep abreast of the developments and to develop 21st century skills, education including pedagogy has undergone a paradigm shift (Kivunja, 2014). The pedagogical implications of smart classrooms also have undergone a paradigm shift.According to Trilling and Fadel (2009), teaching in this new paradigm demands a shift from direct instruction to interactive communication with and among students, from teaching material knowledge to equipping students with necessary competencies, and from teaching content to problem-solving processes. Furthermore, effective teaching in this new paradigm necessitates a shift from teaching fundamental skills to teaching investigative questions and problematizing, from mere theory to practice applying the relevant theory or theories, and from working with a fixed or set curriculum to working on authentic real-life projects. It advocates for a shift away from time-slotted schedules and toward task completion on-demand, from one-size-fits-all teaching to one that provides personalized scaffolding for learners, from competitive learning to collaborative learning, from classroom-bound contexts to free-roaming global learning networks, from textbook-based data to web-based sources, and from summative to formative assessment of students' performance.

2.3. Impact on student achievement

In accordance with the constructivist's principles, smart classroom holds the potential provide opportunities for individualized learning, learning at students' own pace, and differentiated instructions (Moresh, 1995). According to Chachra (2015), smart classrooms increase students' interest, participation and engagement in the classroom, while simultaneously providing an avenue to breakdown difficult concepts into manageable constructs which increases student learning and ultimately performance. Smart classrooms allow students to learn in their own pace while simultaneously allows for teachers to provide differentiated instructions even within the same classroom (Kumari & Denesia, 2013). Phoong, et al. (2019) conducted an experimental study to investigate the differences in the academic performance of students in smart classroom and traditional classroom. 72 undergraduate mathematics students participated in the research. Phoong, et al. (2019) found out that students in smart classroom out performed their peers in traditional classrooms.

3. Methods

The mid-term and annual examination marks of 65 class 5 and class 6 students were used as the primary data for the research. The marks obtained by students in class 4 and class 5, who were currently studying in class 5 and class 6 respectively, was used. Among the class 5 students, 39 were girls and 43 mothers of the students were uneducated, while 43 mothers were either farmers or house-wives. Among the fathers' 18 were educated and 23 were drawing a monthly salary. Among the 33 class 6 students, 16 were female, the mothers of 22 students were uneducated and 21 of the mothers were either farmers or housewives. Twenty-one of class 6 students' fathers were educated while only 19 of them drew a monthly salary or were employed. To analyse the data, the means and standard deviations of the marks obtained were calculated for each of the subjects. To determine the differences across the grades as well as academic terms, t-tests were conducted for each of the subjects.Furthermore, to determine the differences in the students' academic performance based on their father's and mother's educational and occupational status, one way analysis of variance (ANOVA) was conducted.

4. Descriptive results

First the results of class 5 students are presented. The mean marks of term 1 in all the subjects are higher than the term 2 marks, except for Dzongkha. Although the term 1 marks are higher than term 2 marks in almost all the subjects, the variation in the mean mark ranges from less than one to a maximum of less than 2. Term 2 Dzongkha mean mark was greater than term 1 marks, but the differences between the mean marks was less than 1. The results of descriptive analysis are provided in Table 1.

Table 1. Mean marks of two terms for all the subjects for class 5 students

	Minimum	Maximum	Mean	Std. Deviation
English 4 T1	31	49	40.05	4.80
English 4 T2	31	48	38.75	4.52
Dzongkha 4 T1	24	44	35.25	5.81
Dzongkha 4 T2	22	46	35.67	6.15
Maths 4 T1	32	51	41.89	4.91
Maths 4 T2	32	48	38.75	4.20
Science 4 T1	30	48	37.38	4.60
Science 4 T2	24	49	36.67	6.52
Social Studies 4 T1	28	49	38.76	5.80
Social Studies 4 T2	22	48	37.86	7.24

The mean marks of class 6 students, when they were in class 4 revealed differences in term 1 and term 2 marks. Term 2 mean marks were higher than term 1 mean marks in four subjects (English, Dzongkha, Mathematics, and Science) except for social studies. The differences in the improvement ranged from a little more than 1 in science to almost 12 marks in mathematics. However, the decline in students' performance in Social Studies was a little less than 7 marks. The mean and standard deviation of class 6 students marks in class 4 is presented in table 2.

Table 2. Mean marks of class 6 students in class 4

	N	Minimum	Maximum	Mean	Std. Dev
Cl 4 Eng T1	33	13.95	40.70	29.36	7.08
Cl 4 Eng T2	33	14.65	44.80	33.28	7.78
Cl 4Dzo T1	33	14.80	42.50	29.53	7.13
Cl 4Dzo T2	33	21.57	45.33	34.77	6.37
Cl 4 Math T1	33	16.30	36.00	27.33	4.64
Cl 4 Math T2	33	19.25	55.50	39.22	9.28
Cl 4 Sci T1	33	21.78	46.13	34.06	6.46
Cl 4 Sci T2	33	20.61	44.59	35.36	5.77
Cl4 Social Studies T1	33	11.40	48.08	37.27	8.92
Cl4 Social Studies T2	33	12.40	43.80	30.55	8.63

The results of class 6 students in class 5, reveals that term 2 marks of the students are better than their term 1 marks in all the subjects. The smallest increase in mean marks between term 1 and term 2 was in social students, while the greatest difference in mean marks was observed for mathematics. The descriptive results of class 5 mean mark are provided in table 3. The lowest standard deviation was obtained for English in the 2nd term, while the standard deviation of mathematics remained almost consistent in mathematics in term 1 and term 2.

Table 3. Means and standard deviations of class 5 marks

	N	Minimum	Maximum	Mean	Std. Dev
Cl 5 Eng T1	33	20.50	46.66	30.52	7.21
Cl 5 Eng T2	33	32.10	45.51	37.64	3.97
Cl 5 Dzo T1	33	20.60	42.35	31.43	6.30
Cl 5 Dzo T2	33	25.80	47.50	36.95	5.28
Cl 5 Math T1	33	16.90	36.30	28.23	4.39
Cl 5 Math T2	33	36.70	55.00	44.53	4.86
Cl 5 Sci T1	33	25.80	45.85	35.27	5.24
Cl 5 Sci T2	33	29.06	47.20	39.23	4.57
Cl 5 Social Studies T1	33	21.80	49.10	36.16	7.16
Cl 5 Social Studies T2	33	23.50	48.30	36.17	7.13

5. Difference testing

Paired sample t-tests were conducted to determine if there were any significant differences between the mean marks obtained by class 6 students in different subjects in class 5 and 4. The results obtained are shown in table 4. The results revealed that there were significant differences in the mean marks of class 5 and class 4 in English, Mathematics, and Science. The results obtained for English subject suggest that there is a significant difference between class 6 students' class 5 mean marks and class 4 mean marks. The mean mark for class 5 ($M= 34.08$, $SD = 5.37$) was significantly greater than the mean marks of class 4 English ($M = 31.32$, $SD = 7.31$) at $t(32) = -2.48$, $p< .05$. This indicates that class 6 students' performance in English improved substantially and significantly in class 5 compared to their performance in class 4.

Table 4. Results of the paired samples t-test for class 6 students

	Class 4		Class 5		$t(32)$	p
Subjects	Mean	St. Dev.	Mean	St. Dev.		
English	31.32	7.31	34.08	5.37	-2.48	.018*
Dzongkha	32.15	6.50	34.19	5.60	-1.89	.068
Mathematics	33.28	6.72	36.38	4.29	-2.78	.009*
Science	34.71	5.79	37.25	4.65	-2.64	.013*
Social Studies	33.91	8.55	36.16	6.78	-1.73	.094

The results indicated that class 6 students' mean marks of mathematics in class 5 and class 4 differed significantly. The mean marks for class 5 ($M= 36.38$, $SD = 4.29$) was significantly greater compared to the mean marks in class 4 ($M=33.28$, $SD = 6.72$) at $t(32) = -2.78$, $p < 0.001$. This suggests that class 6 students outperformed themselves in class 5 mathematics compared to their performance in class 4. Similarly, students' mean marks in science in class 5 ($M = 37.25$, $SD = 4.65$) was significantly higher than the mean marks in class 4 science ($M= 34.71$, $SD = 5.97$) at $t(32) = -2.64$, $p <0.05$.

Paired samples t-tests were also conducted with the mean marks of term 1 and term 2 of class 5 students obtained in class 4. As mentioned earlier, except for a marginal increase in Dzongkha, students' performance in term 1 was higher compared to their term 2 marks. The results obtained are provided in table 5. The *p*-levels obtained for Dzongkha, Science, and Social Studies were not significant. However, English and Mathematics scores differed significantly.

Table 5. Paired samples t-tests results of class 5 students

Subjects	Term 1		Term 2		*t*(31)	*p*
	Mean	St. Dev.	Mean	St. Dev.		
English	40.05	4.80	38.75	4.52	3.804	.001*
Dzongkha	35.25	5.81	35.67	6.15	-.538	.594
Mathematics	41.89	4.91	38.69	4.26	5.521	.000*
Science	37.38	4.60	36.67	6.52	1.098	.281
Social Studies	38.76	5.80	37.86	7.24	.857	.398

Term 1 English marks (*M= 40.05, SD = 4.80)* was significantly greater compared to term 2 English marks (*M= 38.75, SD = 4.52)* at *t*(31) = 3.804, *p<.005.* Similarly, term 1 mathematics marks (*M=41.89, SD = 4.91)* was significantly higher compared to term 2 mathematics marks *(M = 38.69, SD = 4.26)* at *t*(31) = 5.521, *p<.001.*

One-way analysis of variance (ANOVA) was performed to determine if there were any significant differences between the means marks of class 6 students in class 5 and class 4. The mean marks were used as the dependent (outcome) variables, while mother's job, father's job, and parent's education were used as the independent (predictor) variables. The ANOVA results revealed no significant differences between class 4 and class 5 marks in all the subjects, when disaggregated by parents' demographic characteristics.

6. Accepting and rejecting the research hypothesis

In the following sections, the research hypothesis is tested based on the significance levels obtained for the difference testing. A minimum significance level of 0.05 is generally accepted (Cohen, et al., 2018; Creswell & Creswell, 2017) for hypothesis testing.

Hypothesis 1: There are significant differences between the academic performance in STEM subjects, across the terms and grades.

The mean marks of class 5 students in Mathematics and Science when in class 4 showed mixed results. There were no significant differences in the mean marks in science. However, in terms of mathematics, the mean marks of term 1 was significantly higher than the mean marks of term 2. Therefore, based on the mean marks in term 1 and term 2 of science and mathematics marks, the hypothesis cannot be accepted. In terms of class 6 students, the mean marks of both mathematics and science in class 5 was significantly greater than the mean marks in class 4. This indicates that across the grades there are significant differences in the scores in both mathematics and science. Therefore, the hypothesis holds true for class 6 students' performance in STEM subjects.

2. There are significant differences between the academic performance in language subjects, across the terms and grades.

Although the mean mark of class 5 students in Dzongkha in term 2 was greater than term 1, the difference was non-significant ($p>0.05$). The English term 2 marks of class 5 students was lower than term 1 mean scores, when they were in class 4. The differences in the English marks were significant ($p < .05$). Therefore, it can be concluded that there are insufficient evidences either to reject nor to accept the hypothesis.

Again, although the mean marks of class 6 students in Dzongkha was greater in class 5 compared to the mean marks in class 4, the differences were non-significant ($p > .05$). However, on the contrary, the mean mark of English in class 5 was significantly greater than the mean marks in class 4. Therefore, there is insufficient evidences to either accept or reject the hypothesis, when English and Dzongkha combined is taken as language subjects.

3. There are significant differences between the academic performance in arts subjects, across the terms and grades.

For social studies, the mean marks both across the terms in class 4 for students in class 5, as well as across the grades in class 4 and 5 for students who are in class 6, revealed non-significant differences ($p > .05$), although there were absolute differences in the mean marks. The hypothesis, therefore can be rejected.

4. There are significant differences between the academic performance based on parent's educational and occupational status.

The ANOVA results, with mean marks for both the cohorts of students when disaggregated by parent's educational attainment and occupational status, did not reveal any significant differences ($p > .05$). Therefore, the hypothesis can be rejected and restated as there are no significant differences between the academic performance of the students and parents' educational attainment and occupation.

7. Discussions

The results of this research indicate that while there is significant improvement in student performance across the grades, the evidences suggest that students' performance in the term examinations actually decrease in some of the subjects. Perhaps, this is because of the fact the class 4 is the beginning of Key Stage 2 in the Bhutanese educational context, and there are documented evidences which suggests that students find it difficult to cope with instruction because of the demanding curricular expectations (Education Sector Review Commission, 2010; Jonhson, et al., 2008). The decline in class 5 students' performance in class 4 may also be explained by the students' proficiency in coping with smart learning environments. Students at this age perhaps do not have the necessary skills and access to technology to effectively integrate technology in their learning. This represents the first-order barriers to technology integration, since the challenges of integrating technology is external to the teacher (Ertmer, 1999; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, &Sendurur, 2012). The demographic characteristics of the students indicate that the majority of their parents are farmers, who are predominantly subsistence farmers in Bhutan. The links to students' access to technology and socio-economic status of the families have suggests that students from lower socio-economic status do not have access to technology in their home environment (Harris, et al., 2017).

The research also found that there were non-significant differences in Dzongkha and Social Studies performances, both across the terms and grades, which are subjects which are germane to Bhutan. On the contrary, English, Science, and Mathematics performance were obtained to have significant differences, especially across the grades. Perhaps this is because Dzongkha and Social Studies, subjects which are germane to Bhutanese education system, do not have enough online materials to support teaching and learning in a smart learning environment. Bhutan embarked on the development of customized online materials only prior the nation-wide school closure in 2020 because of COVID-19 (Drukpa, 2021), and as of March 2023, only 1668 digital learning materials were online (Sharma, 2023), covering all the subjects from class Pre-primary to class 6. Needless to say, the materials for both Dzongkha and Social Studies will be lesser. On the contrary, online learning materials for other subjects which demonstrated significant differences are plentiful on the internet, which can be readily used by the teachers as well as the students, provided they have access to technological devices.

7. Recommendations and directions for future research

Despite the limited exposure and access to smart classrooms, students' academic performance across the grades revealed significant differences in academic performance. Hence, improving the access to technology and smart learning classroom may have unprecedented positive impact on student achievement. Therefore, the Ministry of Education and Skills Development (MOESD) should invest in creating smart learning environment in primary schools. In addition, the MOESD should invest in the development of online learning materials in subjects that are germane to the Bhutanese educational context, since there are plentiful of materials in STEM and English.

While this research contributes to literature on the impact of smart learning classrooms on student academic performance, the exploration on teacher's level of technology integration and teachers' technological pedagogical content knowledge (TPACK) was beyond the scope of this research. Therefore, future research should focus on determining the level of technology integration and TPACK should be conducted.

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