A comparative study of the impacts and students' perceptions of indoor and outdoor learning in the science classroom

Saroja DHANAPAL

Taylors University, 47500 Subang Jaya, Selangor, MALAYSIA

Cally Cheng Yee LIM

Fairview International School, MALAYSIA

E-mail: saroja.dhanapal@taylors.edu.my

Received 12 Aug., 2013

Revised 24 Dec., 2013

Contents

Abstract

The increasing awareness among educators around the world on the specialities of indoor and outdoor learning in enhancing students' academic performance and development of skills and attitudes influenced the purposes and background of this research study (Fägerstam, 2012; Jordet, 2010; Martin, 2010; Rickinson et al., 2004). Two key purposes of this study are to compare and contrast between the impacts of indoor and outdoor learning in improving students' academic performance and also, to discover students' point of views about the integration of both indoor and outdoor learning in science. Predominantly, this is a comparative study of the impacts and students' perceptions of indoor and outdoor learning in understanding science that focuses on raising the standards of academic achievements of primary school students. This study takes on the methodology of mixed methods in which research findings are obtained qualitatively and quantitatively. The findings of this study have proven that indoor and outdoor learning complement each other in improving students' academic performance and have also showed positive responses among the students in choosing outdoors than indoors for learning science. This study can be used as a reference point for further research by investigating the impact of indoor and outdoor learning science with reference to different multiple intelligences and also, how they could also augment students' communication skills.

Keywords: Indoor and outdoor learning, Kolb's experiential learning cycle, science

Introduction

Presently, many nations have an increasing interest in the outdoor learning environment as a constructive complement to the old-fashioned classroom teaching or indoor learning (Fägerstam, 2012; Jordet, 2010; Martin, 2010; Rickinson et al., 2004). Both types of learning have indeed caught the attention of many educators around the world who are actively researching on their impact on different subject areas of learning and to evaluate the different perspectives about them (Fägerstam, 2012; Beard, 2002; Brown, 2004). The Merriam-Webster Dictionary (2013) defines the word 'indoor' as to be something 'relating to the interior of a building' and the word 'learning' as to be the 'act or experience of one that acquires a new knowledge' or 'skill acquired by instruction or study.' Beard and Wilson (2006:80) also found that 'typically, indoor learning environments have been strongly associated with lecture theatres, classrooms and textbooks.' Indoor learning can then be best described as a learning space within a four-walled building whereby children have the opportunity to enhance their knowledge and skills through conventional ways of teaching and learning. On the other hand, outdoor learning is an experiential process of learning by performing acts/experiences that takes place predominantly out of the classroom setting or through exposure to the out-of-doors (Fägerstam, 2012).

Fägerstam's (2012) investigated different perspectives and experiences on outdoor teaching and learning to discover the after-effects of regular school-based outdoor teaching and learning in a junior high school context. The results from her study suggest that the implementation of outdoor learning on regular basis in schools leads to many potential advantages especially in building students' social and emotional dimensions of learning as well as increasing students' motivation and interest to learn through their expression of curiosity, commitment and contentment in the outdoors (Fägerstam, 2012).

This was supported by Hofstein and Rosenfeld (1996 as cited in Abell and Lederman, 2007) who conclude that field trips as one of the many outdoor learning activities to be the most valuable informal science learning and it is voted to be more impactful to students' learning of science as compared to indoor formal learning in schools. They found out that 'learning environments that allow students to interact physically and intellectually with instructional materials through hands-on experimentation and minds-on reflection' make substantial impacts on students' learning of science (Hofstein and Rosenfeld, 1996:87). Nevertheless, they agree that the blend of both learning contexts and methods of outdoor and indoor learning should be diversified to augment the repertoire of learning opportunities among students (Hofstein and Rosenfeld, 1996).

One of the many gaps that were suggested for further research is 'to explore students' experience and perceptions of outdoor teaching (Fägerstam, 2012:70; Brown, 2004). Another gap that they suggest for further research is to investigate the different ways and impacts of both indoor and outdoor learning experiences with the purpose of enhancing the learning of science significantly. Hence, this research paper targets to address these gaps with special attention on the differences and similarities of outdoor learning and indoor learning, its impacts in understanding science as a chosen subject, and different perceptions of students on outdoor learning and indoor learning.

This research aims to answer the following research questions:

1. How does indoor and outdoor learning impact students' academic performance in science?

2. What are students' perceptions about incorporating indoor and outdoor learning in science?

This research paper is based on a framework using Kolb's (1984) Experiential Learning Cycle that consists of four stages in a cyclic model such as Concrete Experience, Reflective Observation, Abstract Conceptualisation and Active Experimentation. Figure 1 shows the framework of Kolb's Experiential Learning Cycle (1984).

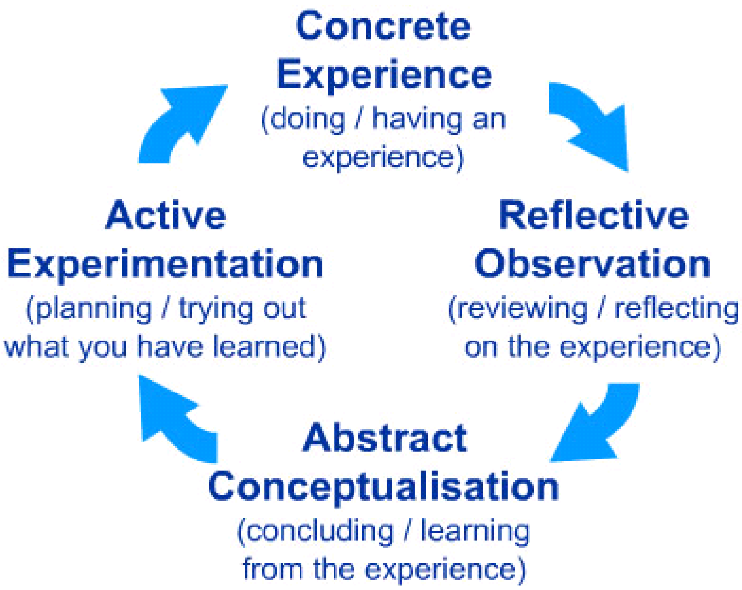

Figure 1. Kolb's Experiential Learning Cycle

This framework was built upon the earlier work of John Dewey (1859-1952) and Kurt Levin (1890-1947). Kolb (1984:38) emphasises that 'learning is the process whereby knowledge is created through the transformation of experience.'

In line with the aim of this research paper, Kolb (1984) states that effective learning is seen when one progresses through the cyclic cycle firstly by having a concrete experience followed by observation of and reflection on that experience which leads to the formation and analysis of abstract concepts and its generalizations and finally, application of the input of knowledge and skills in the world. These principles of experiential learning are the theoretical basis to compare the impact and students' perceptions of indoor learning and outdoor learning in understanding science.

Literature Review

Over time, the arguments for the prominence of rich learning experiences for students' healthy development especially in enhancing academic performance and skills through indoor and outdoor learning activities have been escalating (Fägerstam, 2012; Beard, 2002; Brown, 2004). Access to both types of learning also expands the range of active learning opportunities available to stimulate imagination and creativity (Fägerstam, 2012; Malone, 2008). Harmonising indoor and outdoor learning environments diversify the aptitude that students can operate to exhibit authentic inquiry in numerous subject areas (Malone, 2008).

There are a number of similarities and differences between indoor and outdoor learning. Greenaway (1999, as cited in Beard and Wilson, 2006) shows various similar aspects of indoor and outdoor learning through his interesting and insightful perspective of the terms indoors and outdoors. Firstly, both learning environments evoke powerful images and provide neutral settings with distinct advantages and disadvantages for students to explore. Secondly, both environments are able to offer the same opportunity for students to be managers of their own learning by taking charge of their responsibilities as students. Thirdly, the depth of learning in both the learning environments is profoundly determined by students themselves when they make connections of what they observe and learn. Lastly, the diversity and versatility of learning and teaching approaches can be used in both indoors and outdoors to escalate the learning process of students. It is also agreed in one accord by many educators around the world that such learning environments are tailored for the main purpose of educating students effectively in terms of their knowledge, understanding, skills and attitudes (Beard and Wilson, 2006; Reid, 2005; Brown, 2004).

Despite the similarities identified by Greenaway (1999), indoors and outdoors are reckoned as two separate worlds for students (Spodek and Saracho, 2006). One of the many differences between these learning environments is that outdoors encourage more different types of play activities than the indoors (Spodek and Saracho, 2006). The large space in the outdoors permits for a greater range of movements for students to learn through play-based activities whereas the indoors are limited by the size of the classroom (Spodek and Saracho, 2006). Sensory learning experiences are readily available in the outdoors too (Bruce, 2010). For example, students can observe different types of plants in the natural environment, feel its textures, differentiate its colours and shapes and also, hear the sound of their feet crunching on dry leaves (Bruce, 2010). It is also easier for students to express themselves when they are in the outdoors rather than the indoors in which they need to first develop the sense of belonging and feel welcomed in the classroom before they can take the next step to open themselves up to learn new things (Bruce, 2010).

There is extensive research on the impact of indoor learning in improving students' performance in understanding science. It is argued that rich indoor environments have an immediate, positive effect on the quality of students' learning process (Wardle, 2004). If these indoor classrooms are prudently arranged and designed by the inclusion of few elements of outdoors, it is able to accommodate students' changing interests and needs (Wardle, 2004). The quality of science activities applied in the indoors needs to be strengthened as it broadly affects the on-going classroom engagement and development in science. Consequently, students from different intelligences are able to draw on important scientific skills such as observing, measuring, recording, drawing conclusions and communicating results (Farmery, 2002). Greenman (1988, as cited in Wardle, 2004) also proposes that every indoor classroom should entail constructive traits whereby students are subjected to expressive learning and playing experiences across the curriculum. Statistics prove that 'students spend approximately 20,000 hours in classrooms by the time they graduate' (Fraser, 2001 as cited in Beard and Wilson, 2006:80). The indoors can be equipped with a rich range of resources and materials to support the learning of science in the most appropriate room layouts and organisations unlike the outdoors (Bruce, 2010). Besides that, some physical issues such as furnishings, air quality, lighting and colour also impact the process of learning science indoors. It affects the mood of the learning and thus, defines the pace of students' learning and academic performance.

Conversely, just as much as indoor learning could improve students' performance; it could also drain students' motivation and interest to learn for many reasons (Jackman, 2011). Firstly, the excessive ripple effect of noise level within the classroom setting could indirectly lead to the poor ability of students to remain on-task or concentrate on the work that was given to them (Jackman, 2011). Communication is one of the most important skills to be acquired through the learning of science (Farmery, 2002). Thus, a calm yet proactive classroom is necessary to maximise the learning of science in the indoors. Secondly, indoor learning activities may not be sufficient for kinaesthetic or more outgoing students to explore the world around them and this may limit their amazing potential to advance in their academic performance as they have lesser opportunities to apply their scientific skills (Jackman, 2011). Thirdly, traditional indoor learning applies teacher-centred approaches unlike that of the outdoors with no or little emphasis on the students-centred inquiry process of learning (Shih et. al., 2010). Science, as a subject, is fundamentally fascinating to students and involves them in an adventurous exploration individually or in groups (Farmery, 2002). Such a learning process calls for students to learn science through an open-ended process approach to better understand scientific concepts and grasp essential scientific skills (Farmery, 2002). First-hand experiences should be one of the essentials in teaching (Farmery, 2002). When correct teaching strategies are utilised in the indoors, it will definitely be able to build up students' academic performance in science (Shih et. al., 2010).

Research has also been carried out to evaluate the impact of outdoor learning in improving students' performance in understanding science. Commonly, it is reasoned that outdoor learning is the better platform of active and engaging learning that benefits students the most especially in understanding science rather than learning in the indoors (Duschl et al., 2007; Hayden, 2012; Fägerstam, 2012; Abell and Lederman, 2007). According to Duschl et al. (2007), being scientific includes being curious, observant, inquisitive on how things occur, and discovering how to find the answers. In the outdoors, sensory learning experiences are readily available that boosts students' level of curiosity and excitement to be able to be scientific and actively engage in the practices of science (Bruce, 2010; Duschl et al., 2007). For instance, students have the open access to conduct mini experiments, share ideas with their peers, manage the scientific research process, and discuss the results of the experiments by using the variables and hypothesis (Duschl et al., 2007).

Jeffery (2006) performed a capstone project to gather information from students who have trouble learning in a traditional classroom with the purpose to achieve his main aim in demonstrating the potential advantages of outdoor learning to increase the motivation and enthusiasm of low performance students. Based on his findings, it shows that outdoor learning has enhanced students' exhilaration and preference to participate in the outdoors rather than learning indoors (Jeffery, 2006). Similarly, Fox and Avramidis (2003:268 as cited in Rickinson, et. al., 2004:25), advocate that in the outdoors, 'learning objectives are achieved alongside enjoyable and challenging activities which cannot be performed in conventional settings.' In this argument, as the students enjoy learning science in the outdoors, conceptual development in science occur naturally as a product of the child's learning experiences as well as the learning objectives as planned by the educators are accomplished successfully (Duschl et al., 2007).

Broda (2007, as cited in Hayden, 2012:3) reveals that 'outdoor education motivates the reluctant learner, adds variety to teaching and learning, helps increase student achievement … and is compatible with many current practices in education.' The outdoors offers the space to execute different teaching and learning activities and thus, with the increase of students' active participation, they show greater commitment to improve in their academic performance too. Such blended learning, packed with fun activities and attainable learning objectives is a big plus point to our current trends in education to ensure the prominent quality of teaching and learning in science.

Notwithstanding, outdoor learning is debated to possess many negative impacts on the developmental process of learning science (White, 2011). First of all, any kind of outdoor learning activity is time-consuming and requires a systematic planning (White, 2011). These outdoor activities need to be well-prepared to promote students-centred inquiry according to their learning needs and capabilities so that they will have the opportunity to take charge of their learning. This would also help to accelerate their academic performance in science by instilling creativity, commitment and cooperation among themselves. Secondly, outdoor learning is also constrained due to health and safety concerns (White, 2011). In field trips or visits, there are few complex areas that need extra attention like facilities, equipment, transportation, insurance policy, emergency arrangements and communication in order to ensure a smooth journey before, during and after the field trip or visit. Thirdly, schools have to consider and resolve the negative consequences if students do not confront and conquer risky physical activities that may lead to a decrease in their interest to participate in outdoor activities (White, 2011).

Research has shown that students perceive outdoor learning in different ways. Hayden (2012:6) examined the students' attitudes towards outdoor learning in which 'they were completely immersed in the experience of exploring and discovering the world around them' indicating positive responses from students about learning in the outdoors. They also showed positive on-task behaviour as a result of having positive perceptions about outdoor learning (Hayden, 2012).

Furthermore, students with stronger level of naturalist intelligence enjoy the outdoor learning activities and have stronger, optimistic perspectives than others (Edlund, 2011). Since the natural environment is a perpetual and dynamic stimulator, students are given unlimited opportunities for sensory exploration and creative expression in their learning (Edlund, 2011).

However, Neill (2006) presents his doubts on the intensity of what outdoor learning can offer to students which is in contrast to the common belief that outdoor learning is inherently good. He went on to assert that educational practitioners are not inspired to apply such effective outdoor learning as part of the academic intervention program due to many perceived barriers such as time, liability, defective school policies on outdoor learning and lack of awareness of its effectiveness in improving students' academic performance (Neill, 2006). These factors exemplify the teachers' lack of interest in encouraging learning in the outdoors and thus, causing their students to receive incorrect perspectives about outdoor learning (Neill, 2006).

On the other hand, students' perceptions toward indoor learning are not definite as they are very much affected by factors such as classroom management, teaching strategies, and many others (Reid, 2007). If students feel important and influential in the classroom, they would automatically love the learning that takes place in the traditional classroom setting and show the willingness to engage enthusiastically in the classroom activities (Reid, 2007). It also develops a sense of ownership and belonging being part of the classroom community (Reid, 2007). Another example would be teacher's positive classroom habits (Reid, 2007). Good classroom management skills spread good vibes into the mood or atmosphere of the classroom and invite the involvement of students to pay attention to what is being taught in the classroom (Reid, 2007).

Conversely, consistent old-fashioned teaching and learning strategies will not increase students' passion to learn in the classroom (Savage and Savage, 2009). To a certain extent, it causes them to feel bored if there are no interesting indoor learning activities employed (Savage and Savage, 2009). Their perceptions toward indoor learning would be more negative than positive. Classroom incivility, as a result of poor classroom management, would also be another determining factor to the way students perceive indoor learning (Bjorklund and Rehling, 2010). Disruptive, rude and troublesome behaviour among some students could possibly affect the perceptions and interest of other students learning in the same classroom with them. Poor communication skills between teachers and students, as one of the many observable unhealthy classroom practices in a traditional four-walled classroom, may also elicit negative perspectives about indoor learning (Kohn, 2000).

Methodology

In the education world, teacher researchers have recurrently adopted 'action research' as one of the most reliable research design for classroom research (Thu Hien, 2009). The researchers in this study adopted an action research for its suitability to education has been proven. It involves consistent observation, data collection and changes in practices among teachers to advance students' learning in their learning environment (Miller, 2007; Thu Hien, 2009). This design also provides a framework that directs the energies of teachers toward a better interpretation of why, when, and how students become effective learners (Miller, 2007). According to Lewin (1890 – 1947), action research is also defined as a comparative research on the condition and effects of various forms or fields in educational studies that employs a spiral step which comprises a circle of planning, action and fact-finding about the outcomes of the action.

The sample that was used for this study was a total of twenty-four Grade 3 students from two different classes in School A. In order to reduce biasness based on gender, the sample size consisted of both males and females. These students were given the opportunity to experience both indoor and outdoor learning on a particular theme in the subject area of science. Two teachers from two different classes delivered lessons on man-made structures and materials with similar objectives and teaching methods in their respective classes. Class A with approximately twelve students underwent indoor learning before they headed for an outdoor excursion as part of the outdoor learning on the similar theme of man-made structures and its materials. Conversely, Class B, with the same number of students, experienced the opposite of Class A's learning. The purpose of this reversal teaching and learning methods was to determine the differences in the impacts of both types of learning and their effects on students' understanding of science.

This research also adopted a purposive sampling selection technique in selecting the sample size. In this regard, only students with consistent full attendance with no or less absenteeism were selected as research sample to ensure the reliability and validity of the results of this research. The same sample was given quiz tests before and after their indoor and outdoor learning to verify the variations in their academic performance in understanding man-made structures and its materials. To add on, they also filled up survey questionnaires to share their perceptions on their indoor and outdoor learning experiences. A total of four teachers were selected to plan, observe, discuss and review both the indoor and outdoor learning activities before and after the lessons. This was done to ensure consistency and validity of the results in this study. This research study lasted for about five to six weeks. Finally, all the results that were obtained through the methodological triangulation methods were tabulated and evaluated using tables and charts. The findings of this study are discussed through analytical means.

Findings and Discussion

The data was collected and then processed in response to the research. This research study identified gaps by comparing the differences and similarities of indoor and outdoor learning in terms of its impact on students' academic performance in learning science among a total of 24 Grade 3 students and also explored the students' perceptions towards both forms of learning.

The Wilcoxon test, which refers to either the Rank Sum test or the Signed Rank test was used to compare the two paired groups. The test essentially calculated the difference between each set of pairs and analysed the differences. The Wilcoxon Rank Sum test was used to test the null hypothesis that two populations have the same continuous distribution. The test as the nonparametric equivalent of the paired student's t-test was used as an alternative to the t-test as the population data did not follow a normal distribution. The purpose was to analyse the relationship between indoor and outdoor learning in improving students' performance in understanding science by investigating the degree of complementary of both types of learning. This was performed for both the samples of Grade 3 students from Class A and Class B, each with twelve students who were present throughout the entire research process to maintain consistency in data collection and analysis. Further, pie chart and tables are used to present clear qualitative results of students' perceptions toward indoor and outdoor learning.

As mentioned earlier, quiz tests were given to the sample of this study to tackle the first and second research questions. The answers to the quiz tests were then graded.

Their marks were then tabulated and analysed by using the Wilcoxon Signed Rank test. The purpose of collecting these data was to investigate the connection of the two types of learning to improve students' academic performance in learning science. The data was also organised in two simple tables differentiating the total marks out of 15 marks after they have experienced both the indoor classroom science lesson and school excursion as part of the outdoor learning.

	Indoor	Outdoor	sgn	abs	Ri	sgn.Ri
CA S1	10	12	0	2	0	0
CAS2	15	15	0	0	0	0
CAS3	8	10	-1	2	1	-1
CAS4	10	12	-1	2	4	-4
CAS5	11	12	-1	1	4	-4
CAS6	11	13	-1	2	4	-4
CAS7	12	14	-1	2	4	-4
CAS8	11	14	-1	3	4	-4
CAS9	12	12	-1	0	7	-7
CAS10	8	15	-1	7	8	-8
CAS11	8	13	-1	5	9	-9
CAS12	10	14	-1	4	10	-10
N=	10	12				55
AVERAGE=	10.5	13				
STDEV=	2.022599587	1.477097892				

Figure 2. Wilcoxon test (Class A)

Figure 2 shows the Wilcoxon results of Class A. There are two variables in this study indicating the two types of learning. Variable 1 (Indoor) indicates the total individual marks of the first sample, 12 students from Class A, after they had learned an indoor classroom science lesson on man-made structures and its materials with the same learning objectives with that of the outdoor learning. On the other hand, Variable 2 (Outdoor) indicates the total individual marks of the first sample after they had participated in the school excursion as part of the outdoor learning. The Wilcoxon T test resulted in a value of 55 which is compared to be more than the critical value of 14 for 12 data as given in [1]. This clearly suggests we have to reject the median difference between the results obtained after the indoor lesson and outdoor lesson test marks is zero. Hence we can conclude there are differences in marks between the two tests conducted. Based on the marks obtained by the students, the test conducted after the outdoor lesson yielded better results compared to the test carried out after

the indoor lesson.
[1] http://www.sussex.ac.uk/Users/grahamh/RM1web/WilcoxonTable2005.pdf

	Indoor	Outdoor	sgn	abs	Ri	sgn.Ri
CBS1	13	15	0	2	0	0
CBS2	11	13	0	2	0	0
CBS3	10	10	0	0	0	0
CBS4	10	10	0	0	0	0
CBS5	11	11	-1	0	1.5	-1.5
CBS6	8	10	-1	2	1.5	-1.5
CBS7	12	15	-1	3	4.5	-4.5
CBS8	8	15	-1	7	4.5	-4.5
CBS9	13	13	-1	0	4.5	-4.5
CBS10	11	12	-1	1	4.5	-4.5
CBS11	12	13	-1	1	7	-7
CBS12	13	15	-1	2	8	-8
N=	13	15				36
AVERAGE:	11	12.66667				
STDEV=	1.758098	2.059715				

Figure 3. Wilcoxon test (Class B)

Figure 3 shows the Wilcoxon test results of Class B. The Wilcoxon T test resulted in a value of 36 which is compared to be more than the critical value of 14 for 12 data as given in [1]. This clearly suggests we have to reject the median difference between the results obtained after the indoor lesson and outdoor lesson test marks is zero. Hence we can conclude there are differences in marks between the two tests conducted. Based on the marks obtained by the students, the test conducted after the outdoor lesson yielded better results compared to the test carried out after the indoor lesson.

Hence, this confirms that indoor and outdoor learning complement each other to improve students' academic performance in science. It also justifies the findings of Malone's (2008) report that learning experiences in both indoors and outdoors are essential as they also expand the range of active learning opportunities available to stimulate imagination and creativity among students. Not only that, Bruce (2010:61) comments that 'the indoor and outdoor environments should complement rather than duplicate each other' as she believes that different learning objectives can be best achieved in the provision of different learning environments in various subjects.

Complementary to this, Wardle (2004) also shows the importance in constructing active and deep learning of science than just a short-term learning of unconnected facts and concepts for students in both indoor and outdoor learning environments.

Besides that, as the first response to the research questions, this paper has confirmed that both types of learning have impact on students' academic performance in science. These data findings support distinctly the argument of many educators who support the notion of the impacts of outdoor learning in improving students' academic performance in science (Jeffery, 2006; Bruce, 2010; Duschl et al., 2007; Hayden, 2012; Fägerstam, 2012; Abell and Lederman, 2007). Conceptual development in science occurs naturally as a product of the child's learning experiences in the outdoors and subsequently, improving the progressive development of their scientific skills (Duschl et al., 2007; Farmery, 2002).

Nonetheless, there is a number of students in both samples that have achieved the same total individual marks when learning both in the indoors and outdoors unlike the other students. Table 1 and Table 2 show the results of the total individual marks of six students who obtained similar marks in their quiz tests from Class A and Class B respectively.

Table 1. An excerpt of Class A's Students Quiz Test Individual Marks

Class A		
Total Number of Students: 12	Individual Marks (Full Marks: 15)	
Numeric Coding of Students	Pre-Quiz Test (After Indoor Learning)	Post-Quiz Test (After Outdoor Learning)
2	15	15
9	12	12

Table 2. An excerpt of Class B's Students Quiz Test Individual Marks

Class B		
Total Number of Students: 12	Individual Marks (Full Marks: 15)	
Numeric Coding of Students	Pre-Quiz Test (After Indoor Learning)	Post-Quiz Test (After Outdoor Learning)

22	10	10
23	10	10
24	11	11
28	13	13

Based on the findings in Table 1 and Table 2, it can be argued that both indoor and outdoor learning have relatively equal impact on these students' academic performance in understanding science. This supports the viewpoints of several researchers who believe that both types of learning may actually impact students in the same manner due to their similarities and few presumably influential factors like dissimilar students' learning intelligences and the effectiveness in the delivery of scientific instructions (Wilson, 2006; Edlund, 2011; Shih et. al., 2010).

One of the similarities of both indoor and outdoor learning is that they offer the same opportunity for students to be managers of their own learning and the depth of their learning is profoundly determined by students themselves when they make connections of what they observe and learn (Wilson, 2006). By taking charge of their learning, students would have different levels of interest and thus, affecting their attention time span level in engaging with the indoor and outdoor lessons. Since this research study also employed two different teachers for the indoor and outdoor lessons in Class A and Class B respectively, it must be conceded that students may be affected by the delivery of learning and instructions during lessons. This is supported by Wilson's (2006) idea that the diversity and versatility of learning and teaching approaches in giving scientific instructions in both indoors and outdoors affects the learning process of students.

In general, all students possess different learning intelligences and preferences in understanding science (Farmery, 2002). Students would then acquire important scientific skills such as observing, measuring, recording, drawing conclusions and communicating results at different pace too (Farmery, 2002). These six students could probably be stronger in different intelligences than that which was catered for during the indoor and outdoor lessons about man-made structures and its materials. Along these lines, this paper also recognises that Student 2 in Class A is the only student that achieved full marks for both indoor and outdoor learning. This paper views Student 2 as one who is perhaps a very flexible and responsible student full of curiosity that possesses strong multiple intelligences that aids him/her in learning science.

Survey questionnaires were given to both the samples of this research study to discover their perceptions toward both indoor and outdoor learning in understanding science. The questionnaires contain five questions that were designed to tackle the research questions of this study. Pie chart and tables are used to present clear qualitative results of students' perceptions toward indoor and outdoor learning in advancing students' academic performance in learning science. Four teachers were involved throughout the research process playing the role of facilitators of both indoor and outdoor learning. All four teachers wrote their reflection on different aspects of the lessons in the classroom observation forms. The findings from these indoor and outdoor classroom observation forms are also discussed where relevant to consolidate the qualitative findings of this research study.

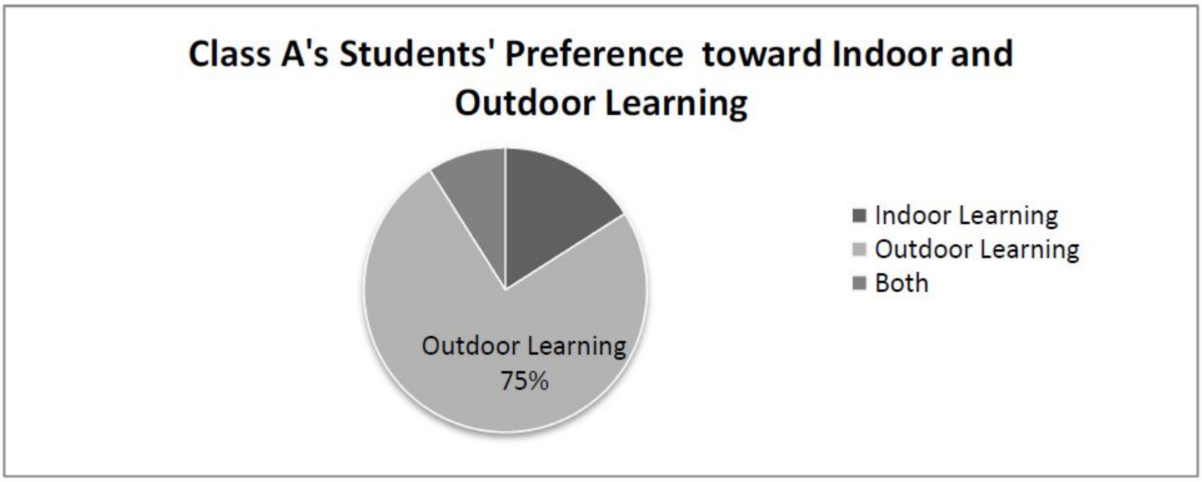

Figure 5. Percentages of Students' Perceptions toward Indoor and Outdoor Learning in Class A

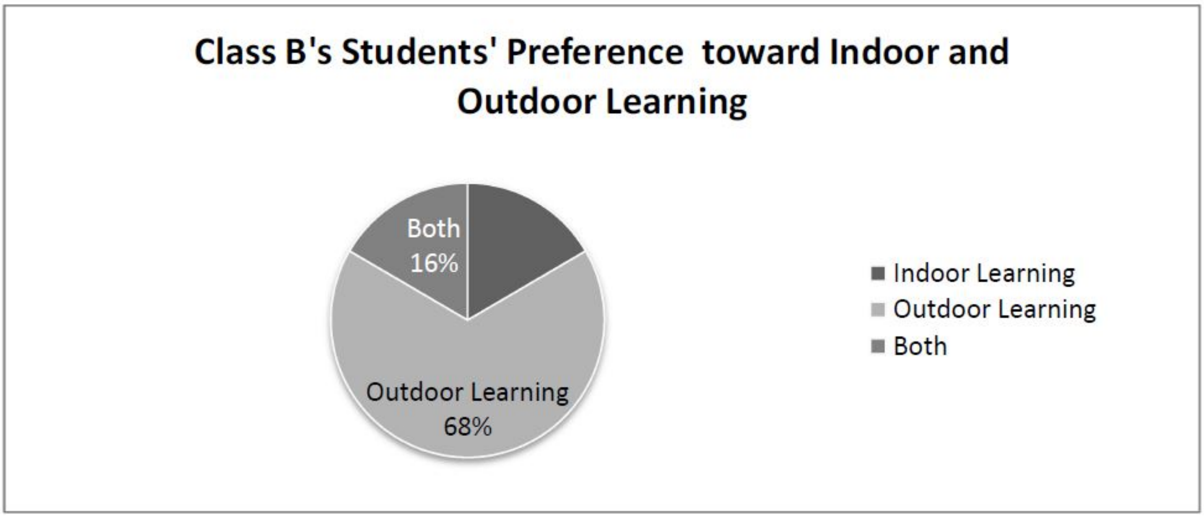

Figure 6. Percentages of Students' Preference toward Indoor and Outdoor Learning in Class B

Figure 5 and 6 are the tabulation of the responses to the first question posed in the survey questionnaire. Figure 5 shows that a total of 75% of the sample in Class A prefers learning outdoors, 16% indoor learning and 9% both two types of learning whereas Figure 6 shows that a total of 68% of the sample in Class B enjoys outdoor learning, 16% indoor learning and the remaining 16% both types of learning. One significant conclusion that can be made from Figure 5 and Figure 6 is that most students in both the classes enjoy being outdoors for learning science than indoors. Thus, students showed a much more positive response towards outdoor learning in comparison to indoors learning. This is further discussed and illustrated with excerpts of responses to the fourth question posed in the survey questionnaire on the reasons why they enjoy being outdoors to learn science.

Table 3. Excerpts of Class A's Students' Perceptions toward Outdoor Learning

Class A	
Question 4: Why do you enjoy learning and understanding science outdoors?	
Numeric Coding of Students	Students' Responses
2	We can explore and search for new things we can see outside.
9	We can see more structure and all the view.
11	We can see the real thing.

Table 4. Excerpts of Class B's Students' Perceptions toward Outdoor Learning

Class B	
Question 4: Why do you enjoy learning and understanding science outdoors?	
Numeric Coding of Students	Students' Responses
24	Because it is very exciting and also very fun when I was learning.
26	Because I get to see more things and learn more things.
28	Because we can listen to birds singing.

Based on the findings in Table 3 and Table 4, students expressed in their own words that they are able to observe and explore the buildings and nature with excitement. This links back to Hayden's (2012) findings whereby she examines students' positive responses toward outdoor learning in which they were entirely engrossed in the experience of exploring and discovering the world around them. To add on, the responses in Figure 5 and Figure 6 have also proven that outdoor learning has enhanced students' enjoyment and this is similar to the findings of previous research (Jeffery, 2006). Students are also making connection of their science learning through sensory learning experiences which are readily available in the outdoors (Bruce, 2010). Student 28 in Class B expressed his/her feelings that he/she can listen to the birds singing while Student 9 in Class A expressed that he/she can see more structures and get a complete view. This paper agrees with Edlund (2011) that such responses are significant indicators of the power of the natural environment as a perpetual and dynamic stimulator for sensory exploration and creative expression in learning science.

On the contrary, there is a lesser percentage of 16% in both classes for those who prefer staying indoors to learn science as illustrated in Figure 5 and Figure 6. The reasons given by the samples are shown in Table 5 and Table 6.

Table 5. An excerpt of Class A's Students' Perceptions toward Indoor Learning

Class A	
Question 4: Why do you enjoy learning and understanding science indoors?	
Numeric Coding of Students	Students' Responses
3	We see many things and do many things.
10	Because we can explore more.

Table 6. An excerpt of Class B's Students' Perceptions toward Indoor Learning

Class B	
Question 4: Why do you enjoy learning and understanding science indoors?	
Numeric Coding of Students	Students' Responses
21	Because it is fun.
27	Because we can learn and have fun at the same time.

It is interesting to note that the responses given by students who prefer to learn indoors as described in the excerpts are almost similar to those who picked outdoors as their best option. These responses are in consensus with Wardle's (2004) research that was done to prove that rich, indoor environments have the potential to give an instant, positive effect on the quality of students' learning process. These four students from the two different classes voiced out that they can also observe and explore different things with joy in indoor traditional classroom settings. The quality and diversity of science activities applied in the indoors can broadly affect the on-going classroom engagement and development in learning (Wardle, 2004). All 24 students in this study experienced the same teaching activities that reflect the inquiry cycle of Kolb's (1984) Experiential Learning Cycle. The lesson began with a Word Splash activity to test their prior knowledge on man-made structures, short videos on how different materials are used to make a structure, hands-on activity by using different materials to create their own structure followed by a slideshow presentation and ended with reflection time to summarize their learning.

Furthermore, both the classrooms were equipped with several resources and materials to support the learning of science such as library books, science corner and classroom displays. The classrooms were also well-maintained and thus, gave good vibes for students to learn and participate in classroom-based activities. To elaborate further, the researchers agree with previous research findings that have proven that active, engaging learning can still take place in the indoors by bringing in some constructive traits that are subjected to expressive learning and playing experiences (Greenman, 1988 as cited in Wardle, 2004). Since students spend most of the time in the classroom, they automatically love the learning that takes place in the traditional classroom setting and show the willingness to engage enthusiastically in the classroom activities too as they feel comfortable (Reid, 2007). Plus, students who have a strong intrapersonal learning intelligence will definitely enjoy being indoors than the outdoors as they are independent learners.

Another finding that the researchers would like to highlight is the students who chose both types of learning as their preference in understanding science. The findings are shown in Table 7.

Table 7. Responses from students who preferred both types of learning

Numeric Coding of Students	Responses
12	'We need to have something new every lesson'
21	'Yes, you can never do everything every day because you need to try something new'

These two students revealed their viewpoints on the rationale of selecting both indoor and outdoor learning as being part and parcel of their science learning. The combination of both types of learning in science lessons are important as it can provide a wider range of new learning activities to be executed in and out of the classroom. In the same way, the diversity and versatility of learning and teaching approaches can be adopted in both indoors and outdoors to accelerate the learning process for students (Wilson, 2006). Likewise, it is also agreed by many educators around the world that both learning environments are tailored for the main purpose of educating students effectively in terms of their knowledge, understanding, skills and attitudes (Wilson, 2006; Reid, 2005; Brown, 2004).

Conclusion

At present, best teaching and learning approaches in different learning settings are overrated. The evolving pace of this multifaceted world has triggered the growing number of such demands in promoting the development of children's wellbeing especially in learning science (Prensky, 2005; Hofstein and Rosenfeld, 1996; Abell and Lederman, 2007). Hence, this research study was carried out to examine and evaluate the impacts and students' perceptions of indoor and outdoor learning in understanding science. Along these lines, this action research study was planned 'to explore students' experience and perceptions after outdoor teaching had been a regular practice for a substantial period of time' in relevance to the context of the current school setting involved in this research. Likewise, this research study is momentous in contributing new ideas and main findings to the emergent body of knowledge relating to the practice of both indoor and outdoor learning in schools.

The accumulated findings of this research study have established three main points that can be beneficial for further investigation. Firstly, both indoor and outdoor learning complements each other to improve students' academic performance in science. This has been tested and analysed by using the Wilcoxon test. Secondly, outdoor learning provides more effective and influential impacts on students' academic performance in understanding science despite the small number of students who maintained their marks in their quiz tests after experiencing both indoor and outdoor learning. Thirdly, students are more zealous to participate in the outdoors than staying indoors as they are provided with wide-ranging opportunities to observe, explore and make connection of their science learning through sensory learning experiences in the outdoors even though there are some minor percentages of students that prefer indoor learning or both types of learning.

After a thorough data analysis, the researchers would like to make several recommendations for further research. An area for further research is to explore how different multiple intelligences would affect the choice and perceptions of students to learn indoors or outdoors. Another area for research is to investigate the effectiveness of learning science through the indoors and outdoors in enhancing students' communication skills. Finally, another point for further research is to investigate the impact of indoor classroom provision like manipulative, tools and materials to carry out experiments, and other resources in building up students' scientific skills.

References

Abell, S. K., and Lederman, N. G. (2007). *Handbook of Research on Science Education*, USA: Lawrence Erlbaum Associates.

Beard, C. (2002). *The Power of Experiential Learning: A Handbook for Trainers and Educators*, UK: Kogan Page.

Beard. C., and Wilson, J. P. (2006). *Experiential Learning: A Best Practise Handbook for Educators and Teachers*, UK: Kogan Page.

Bjorklund, W., and Rehling, D. (2010). Student Perceptions of Classroom Incivility, COLLEGE TEACHING, 58 (1). p 15–18, Available at: http://www.buffalostate.edu/professionaldevelopment/documents/spc.pdf (date accessed: 13/03/2013). .

Brown, G. (2004). *How Students Learn*, London: Routledge Education.

Bruce, T. (2010). *Early Childhood: A Guide for Students*, India: SAGE.

Coyle, K. J. (2010). *How Outdoor Education and Outdoor School Time Create High Performance Students*, London: National Wildlife Federation.

Davis, B., and Sumara, D. (2000). *Engaging Minds – Learning and Teaching in a Complex World*, London: Lawrence Erlbaum Associates.

Duschl, R., Schweingruber, H., and Shouse, A. (2007). *Taking Science to School: Learning and Teaching Science in Grades K-8*, Washington: THE NATIONAL ACADEMIES PRESS.

Edlund, D. (2011). Student Perceptions of Outdoor Educational Experiences, Available at: http://proquest.umi.com/pqdlink?did=2260547641&Fmt=14&VType=PQD&VInst=PROD&RQT=309&VName=PQD&TS=1364152464&clientId=79356&cfc=1 (date accessed: 03/03/2013).

Fägerstam, E. (2012). *Perspectives on outdoor teaching and Learning*, Sweden: Department of Behavioural Sciences and Learning.

Farmery, C. (2002). *Teaching Science 3-11: The Essential Guide*, Great Britain: Continuum International Publishing.

Farrell, J.B. (2010). Active Learning: Theories and Research, Available at: http://www.lookstein.org/online_journal.php?id=260 (date accessed: 20/02/2013).

Haack, K. (2008). UN studies and the curriculum as active learning tool. *International Studies Perspectives Journals*, *9*(1), 395-410.

Hayden, L. N. (2012). Leaving the Classroom Behind: Increasing Student Motivation through Outdoor Education, Available at: http://www.smcm.edu/educationstudies/pdf/rising-tide/volume-2/VOL2-article1.pdf (date accessed: 03/03/2013).

Hofstein, A., and Rosenfeld, S. (1996). Bridging the Gap Between Formal and Informal Science Learning. *Studies in Science Education*, *28*(1), 87-112, Available at: http://www.bobpearlman.org/BestPractices/Israel/Bridging%20the%20Gap.pdf (date accessed: 01/03/2013).

Institute for Outdoor Learning (2013). How Much Outdoor Learning is going on? Available at: http://www.outdoor-learning.org/Default.aspx?tabid=209 (date accessed: 25/02/2013).

Jeffery, P. (2006). *Outdoor Learning As An Alternative To The Classroom For Struggling Students: Does It Increase Motivation And Enthusiasm?*, UK: Hamline University.

Joyce, R. (2012). *Outdoor Learning: Past or Present*, England: Open University Press.

Kolb, D. (1999). Experiential Learning Theory: Previous Research and New Direction. Available at: http://www.d.umn.edu/~kgilbert/educ5165-731/Readings/experiential-learning-theory.pdf (date accessed: 02/03/2013)

Jackman, H. (2011). *Early Education Curriculum*, UK: Cengage Learning.

Jordet. A. (2010). The classroom outdoors. Education in an extended context]. Latvia: Cappelen Damm AS.

Kohn, A. (2000). *The Schools Our Children Deserve: Moving Beyond Traditional Classrooms and "Tougher Standards"*, USA: Houghton Mifflin Harcourt

Kumar, R. (2011). *Research Methodology*. India: APH.

Loynes, C. (2008). A Review of Outdoor Education Research, Available at: http://www.thresholdconsulting.co.uk/phdthesisPDF/chapter3.pdf (date accessed: 05/03/2013)

Malone, K. (2008). Every Experience Matters: An evidence based research reporton the role of learning outside the classroom for children's whole development from birth to eighteen years. Report commissioned by Farming and Countryside Education for UK Department Children, School and Families, Australia.

Martin, P. (2010). Outdoor education and the national curriculum in Australia. *Australian Journal of Outdoor Education*, *14*(29), 3-11.

Merriam-Webster (2013). Online Dictionary and Thesaurus. Available at: http://www.merriam-webster.com/ (date accessed: 05/03/2013).

Miller, M. (2007). 'Action Research: Making Sense of Data', Available at: http://www.coe.fau.edu/sfcel/sensdata.htm (date accessed:15/03/2013).

Neill, J. (2006). Outdoor Education in the Schools: What Can It Achieve?, Available at: http://www.wilderdom.com/html/OutdoorEducationInSchoolsWhatCanItAchieve.html (date accessed: 15/03/2013).

Onwuegbuzie, A., Johnson, B., and Turner, L. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*, *1* (1), 112-133.

Pascal, C. B. (2000). Scientific Misconduct and Research Integrity for the Bench Scientist. *The Society of Experimental Biology and Medicine*, *224*(4), 220-230. Available at: http://ebm.rsmjournals.com/content/224/4/220.full (date accessed: 03/03/2013).

Prensky, M. (2005). Engage Me or Enrage Me: WHAT TODAY'S LEARNERS DEMAND. Available at: http://net.educause.edu/ir/library/pdf/erm0553.pdf (date accessed: 16/03/2013).

Reid, G. (2005). *Learning Styles and Inclusion*, California: SAGE.

Reid, G. (2007). *Motivating Learners in the Classroom: Ideas and Strategies*, California: SAGE.

R. J. Sternberg and L. F. Zhang (Eds.). (2000). *Perspectives on cognitive, learning, and thinking styles.* NJ: Lawrence Erlbaum.

Rickinson, M., Dillon, J., Teamey, K., Morris, M., Young Choi, M., Sanders, D., and Benefield, P. (2004). A Review of Research on Outdoor Learning. Available at: http://www.peecworks.org/PEEC/PEEC_Research/01795BFA-001D0211.0/NFER%2520Exec%2520Summary.pdf (date accessed:01/03/2013)

Savage, T., and Savage, M. (2009). *Successful Classroom Management and Discipline: Teaching Self-Control and Responsibility*. UK: SAGE.

Shih, J. L., Chuang, C.W., and Hwang, G.J. (2010). An Inquiry-based Mobile Learning Approach to Enhancing Social Science Learning Effectiveness. *Educational Technology & Society Journal*, *13*(4), 50–62.

Spodek, B., and Saracho, O. N. (2006). *Handbook of Research on the Education of Young Children.* New Jersey: Routledge.

Tal, R. (2001). Incorporating field trips as science learning environment enrichment-an interpretative study. *Learning Environments Research Journal*, *4*(1), 25-49.

Thu Huen, T. T. (2009). Why is action research suitable for education? *VNU Journal of Science and Foreign Languages, 25*(1), 97-106. Available at: http://tapchi.vnu.edu.vn/nn_2_09/b4.pdf (date accessed: 01/03/2013).

Wardle, F. (2004). Creating Indoor Environments for Young Children. Available at: http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?ArticleID=294 (date accessed: 06/03/2013).

White, J. (2011). *Outdoor Provision in the Early Years*, California: SAGE.

Willms, J. D. (2000). Student Engagement At School. Available at: http://www.oecd.org/education/school/programmeforinternationalstudentassessmentpisa/33689437.pdf (date accessed: 06/03/2013).