

School – Based Activities: A Tool for Student Development

Dk. Hajah Siti Fatimah Pg. Hj. Petra, MA (Ed.), BSc. (Ed.)

Currently a PhD candidate

University Brunei Darussalam reading PhD in Education

Maktab Sains Paduka Seri Begawan Sultan

Jalan Muara

Bandar Seri Begawan

Negara Brunei Darussalam

Abstract

This paper describes a new tool based on activities carried out within the school environment. The process enables evaluation of the relationship between school-based activities (SBA) and students' development. Guides on weightings of assessment are given. There is some discussion of the perceived benefits of the SBA tool.

Key Words: Evaluation, Benchmarking, Science Education, Science and Technology (STS), Teacher Training, School Assessment, School curriculum, School Culture

Introduction

'The total development of our people is essential to achieving our goal of corporate excellence. ... Another and equally important reason why we encourage our people in this quest is the impact which full personal development can have on individual happiness. To seek personal fulfilment only outside of work and to ignore the significant portion of our lives which we spend working, would be to limit our opportunities to be happy and complete human beings.' (O'Brien, 1990)

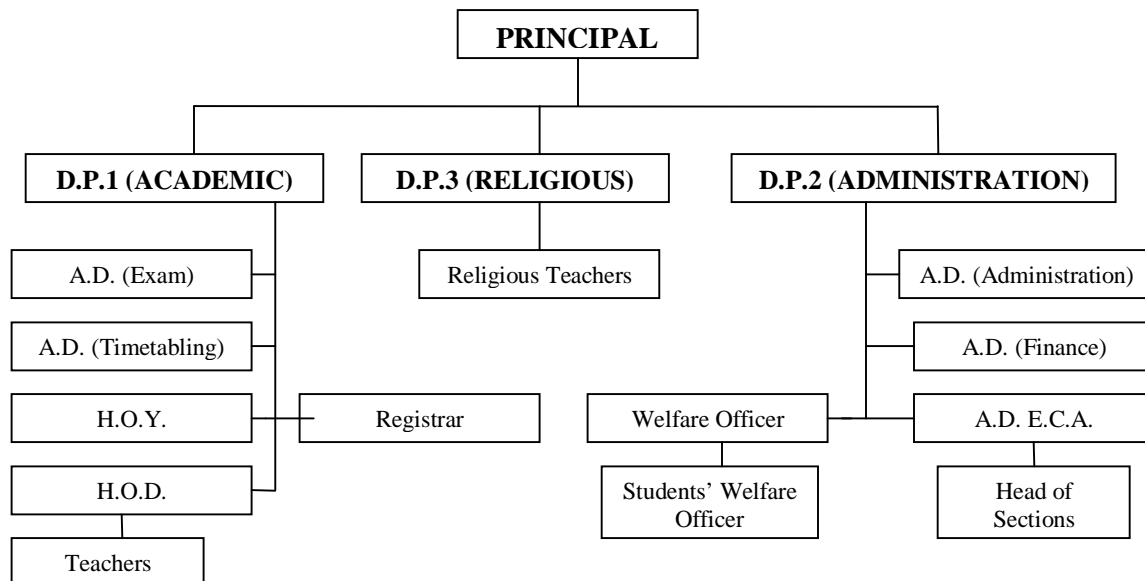
Different countries show wide variations in the way they organise their school systems; even in Brunei Darussalam, the Ministry of Education had emphasized a 7-3-2-2 pattern, representing primary, lower secondary, upper secondary and pre-tertiary respectively until the year 2010. The current school system following the 21st century National Education System is adopting 7 – 2 – 2 or 7 – 2 – 3 pattern in a 12 – year compulsory education. Regardless the differences in the education system's pattern, schools serve a common purpose in educating children directly and indirectly, and preparing them to function as assets within their society. The educational policy of Brunei Darussalam seeks to educate the nation's youth to fulfil their own and, ultimately, the nation's full potential (Minister of Education, Brunei Darussalam, 2004). The aim is to promote the maximum personal development of individuals who will, as a result, prove to be knowledgeable, devout, faithful, skilful, pious, trustworthy, responsible and of noble character (MOE, Brunei, 2004).

Parents are required to send their children for the 12 years of the first three tiers of education and have the right to choose the desired school. In the year 2005, there were thirty-eight government secondary schools and nine private secondary schools in Brunei. Both government and private schools followed a common curriculum and public examinations. Parents are advised to send their children to schools within their local catchment area. This practice also applies to newly qualified teachers, who are assigned to schools near to their homes: an exception being made for schools which need replacements for teachers' leave or other urgent reasons. I was sent to a government secondary school situated at one end of Brunei Darussalam, a ten minute drive from my residence.

The school was administered hierarchically by the principal and three deputy principals, followed by the assistant deputy principals (Fig.1). Teachers were looked after by the heads of departments. In 2005, this was one of the experimental schools, integrating religious subjects, which are normally taught in afternoon religious schools, within the morning's classes. Academic sessions normally run from 7.35am till 12.35 pm, while the normal religious schools operate from 1.30 p.m. until 5.30p.m. Following integration, most of the lower secondary and a few of the upper secondary students would attend lessons from 7.35a.m.until 4.45p.m. The religious teachers were directly managed by the third deputy principal.

The school's vision is to be a caring institution which strives for excellence and its mission is to provide high-quality and equitable education, to maximize students' potential through effective teaching in line with the national aspirations and philosophy, Malay Islamic Monarchy (M.I.B.). The school's goals include:

1. To provide opportunities for students to uphold the principles of M.I.B
2. To create within the school a meaningful, enjoyable and rewarding learning environment
3. To encourage students to be self-disciplined, courteous and have confidence in their own abilities
4. To encourage students to strive to achieve their academic potential
5. To develop channels of clear communication both within the school and with the wider community
6. To provide a spiritual and moral structure that students can relate to and practice
7. To establish programmes that cater for the students' physical well being and which encourage participation and excellence
8. To encourage students to respect and value the school environment
9. To establish in the school appropriate systems that address the pastoral needs of all students.



Key: D.P.: Deputy Principal, **A.D.:** Assistant Deputy Principal, **HOD:** Head of Department, **HOY:** Head of Year

Fig. 1: The school's Administration system

For teaching to be effective, learning must take place. What constitutes effective teaching? Schulman (1987) suggested that effective teaching requires subject knowledge to be translated into plans for learning that respond to the pupils' needs and engage them in the process. A model of effective teaching (Http 1) includes: setting the objectives, testing the participants, teaching the participants, allowing participants to practice and checking what the participants have actually learned. The purpose of planning (Http 1) is to bring together learners and curriculum in such a way that learning will take place. 'Organizations learn only through individuals who learn. Individual learning does not guarantee organizational learning. But without it no organizational learning occurs', (Senge, 1990). The foundation for planning (Http 1) is based on the teacher's understanding of:

- how pupils learn
- the overall structure of the curriculum
- the specific content knowledge, skills and concepts for each subject taught
- pupils' prior knowledge, understanding and skills
- pedagogical content knowledge relevant to the subject
- how sessions can be planned for maximum effectiveness.

Reynolds (1996) stated that it is clear that school effectiveness is mainly determined by classroom effectiveness, which brings the teaching/learning process into the centre of the improvement process.

Improved effectiveness will, therefore, have to lean upon teachers' willingness to adopt a different cultural, as well as organizational, view of their own profession.

Newly Qualified Teachers (NQT) Perspective

For a newly qualified teacher, not *au fait* with the school environment, this was an ideal school in which to teach. The teachers are friendly and helpful; the administrators are quasi-supportive and the students are quiet and sometimes responsive. Most of the students are related to each other, as they arrive from four nearby primary schools as designated by the Ministry of Education. The first few months of teaching Mathematics, relieving a foreign teacher who had finished his contract, proved challenging: the students were sitting the Brunei – Cambridge General Certificate of Education ('O' level) and, for a new teacher with little expertise, revision of the syllabus was especially problematic.

In spite of that, I was chosen (as all others resisted) to facilitate a team of four students from the same class to join an 'Explomaths' display in another school; this was not a competition but a workshop, sharing ideas about how to make Mathematics useful to students. Excited students jumped for joy even though the examination was just around the corner. The 3-day participation was a success, demonstrated by clear signs of satisfaction on students' faces and the sense that they seemed ready for and confident about their Maths exams. Their results turned out to be better than those of students who had not attended the workshop. That was the first and last project to which I contributed, since I left Mathematics for the Science Department.

As a scientist, I am always aware that observation is the necessary pre-requisite for investigation. That criterion was quickly applied to the situation in school, which at that time was in the bottom ten of all the government schools, achieving slightly below the statistical benchmark (Kelly, 2001). The atmosphere in the school was not conducive to great academic efforts and there was not much excitement to entice the students in learning. The school environment lost its charm for me and became less and less challenging after one or two years' teaching. It was, unsurprisingly, true, as Hargreaves (1982) argued:

'once teachers have mastered the basic arts of teaching, knowing how to teach one's subject and how to control a class, then teaching can become too predictable. The challenges and stresses of the early years of teaching may fade, but they are replaced by a new boredom. After ten years of teaching the same subject to the same age range, teachers naturally find it difficult not to be bored by their constant repetition of the same predictable lessons.'

The school did not promote a competitive ethos, and there were no extra-curricular academic activities arranged to encourage students to progress. MacBeath & Mortimore (2001) stated that their analysis of transcripts from primary school interviews in 1997 showed that the most frequently mentioned aspects of learning strategies focused on teaching methodologies. Exposure to real-life experiences seems to have been the key in accounting for the satisfaction of the participants, as in the 'Explomaths'.

School-Based Activities

In attempting to tackle the prevailing atmosphere of alienation, I decided to initiate a weekly quiz, so that students, and particularly those at the level I taught, would participate and would receive reasonable prizes if they won. Prizes were self-sponsored and to be given to those who submitted the correct answers for every week. Questions were subject-based so that students were prompted to remember what they had learnt previously. It is important to gain an understanding of pupils' prior learning when planning, as knowledge of what is expected of most pupils may be gained (Http 1). The programme was a hit for a couple of weeks and the winner was given the prize. The head of department was grateful for the initiative and creativity surged. She decided to revive the Annual Science Quiz: an initiative which had been dropped eleven years previously. The initiative was a team event, as argued by Senge (1990), 'that team learning is a *team skill*. A group of talented individual learners will not necessarily produce a learning team, any more than a group of talented athletes will produce a great sports team. Learning teams learn how to learn together'.

Simultaneously, the proposal I sent to the organizer of a national science competition project was accepted. It was publicly announced that the school would receive \$500 sponsorship to investigate nature with four other selected schools. The overlapping achievements created by the Science Department made the school a little rising star, and this eventually shifted the school culture slightly from a *role culture* to a *task culture* (Hargreaves, 1994).

According to Dalin *et al* (1993), organizational culture operates on three levels corresponding broadly to the Freudian concepts of super-ego, ego and id, described as follows:

- ‘*Transrational*’ – values are conceived as ‘metaphysical’, based on moral and ethical values and codes.
- ‘*Rational*’ – values are grounded within a social and perhaps political context on norms and customs, conventional expectations and standards, and are dependent on ‘collective justification’. At this level, most values are expressed through daily routines, norms, rules, ‘customs and ceremonies’ of the school.
- ‘*Subrational*’ – values are based on personal preferences, experiences and biases, grounded in emotion rather than rational thought, direct and personal, ‘asocial and amoral’. Culture at this level has a powerful role in the school at any point in time.

Although it took quite a long time for the whole school to recognise the success of the Science Department – that is, not until the school won second prize in the competition – it had its impact on other departments. The languages department (Malay and English) started their own activities, quiz competitions and reading week, while others started to join in national competitions. The changes in the school environment positively affected the performance of the school, shifting its ranking from bottom ten to top twenty. It seems that the initiative of one person had lit the firecracker. ‘The teacher’s role is a very important variable in the determination of effectiveness, but the other side of the coin is that teachers’ roles should change...we are aiming at a change in the learning conditions by changing the role of the teacher’ (Reynolds *et al.* 1996).

The school kept shining when the following year it was again selected in the national competition and again won the second prize. The performance of the school also improved, climbing into the top-ten category. I have always believed that involvement in national competition has a direct effect on the students. I assumed that the younger generation of students would want to follow their seniors’ footsteps in competing with other students inside and outside the school, especially when the Cross-Curricular Department organized more activities for various subjects. To demonstrate the truth of this assumption, I devised a science competition between peers for mixed-ability students. The competition required the students to investigate a topic and conduct an experiment on their own (by discovery). Later, the students had to present orally to their peers.

As a result, performance improved all round, with a number of students who had previously failed their first test passing the second one immediately after the competition ended. Students commented they enjoyed the activities and felt confident with Science. ‘This is the first time I feel Science is exciting,’ exclaimed one student. After that, more and more activities mushroomed in various school departments.

Carnell and Lodge (2002) highlighted that in a complex nature of the classroom, if we are to promote a rich learning environment for the twenty-first century, then we will need to encourage the following:

- a shift in responsibility from teachers to learners
- a focus on learning and a learning language
- a shift in the teacher’s role from a behaviour manager to a learning manager
- a move towards the learner’s role as a researcher and a learning partner
- an emphasis on reciprocal teaching and learning
- a view that the territory of the classroom is a shared learning space
- more permeable classroom boundaries

Although other factors may have helped in increasing the students’ performance, satisfaction and a positive attitude towards the subject must not be ignored as these attributes evidently help students to develop mentally, practically and emotionally. In order to test this hypothesis, it is necessary to evaluate the influence of school-based activities (SBA) in developing students’ potential.

Designing SBA Evaluation form

The school-based activities (SBA) do not have to be of a competitive type. However, competing enables students to appreciate time, effort and contribution as well as respecting others. SBA may begin with a subject or topic-related project such as collecting leaves or calculating the number of rectangles in a classroom. The involvement of students in the preliminary step will pursue the following stages:

- acknowledge the number of students participating
- identify the participating students
- recognize the students’ initial ability
- predict the pattern of students’ participation

As the activities become complex, the pattern of students' participation in the next activities is expected to fall – particularly in the case of mixed – ability students – probably due to the nature of activities and the length of time taken to conduct them. This became evident when two groups of students, who were initially eager to start their project during the C.S. (*Combined Science*) projects, failed to send in their work after two months. The students seemed to lose direction. As they commented, they did not know what to do, even after several discussions and leads. The involvement of students in SBA will be monitored and the students' development will be related to their performance in their formative assessment. 'Formative assessment in the sense of gathering information about learning and giving feedback whilst it is in progress has been seen as a crucial aspect of teaching since the Task Group on Assessment and Teaching (TGAT) report was published in 1988' (MacGilchrist *et al.*, 2004)

The hypothesis to be accepted is that there is a significant relationship between students' participation in SBA and the attainment increase in their formative assessments such as tests and examinations. In my school, there were two tests, the first in March and the second in August; mid-year examinations are in June and final-year examinations in October.

The evaluation form is divided into three sections (Fig 2): mini-project (topic-based), trial project (subject-based) and school project (representing the school e.g. competitions). The number of activities in each section depends on the teacher's inclination; the activities should be achievable and each must have its own objective. The time and venue for activities might differ from one teacher to another and from one section to another. Activities for the mini-projects are meant to be completed within a short period: that is from a ten-minute activity to a three-day one. The trial projects may be extended from a period of one week to a few months; and the school projects will depend on the organizer's time limit, usually six months to a year.

At the end of each section, the teacher should monitor the progress of students' participation by considering each respective student's achievement for each activity and the number of students who participated. The former would refer to the level of difficulty of the tasks given while the latter will evaluate how active or responsive the students are. It is imperative to keep a record of all information in a log book for future reference, so that if by any chance mishaps occur, tracing back can be made easier.

In order to relate the students' development to their performance in formative assessment, it is necessary to conduct the mini and trial projects after the first assessment but before the second one. School projects would take a lot of students' time and focus, thus the final-year exam would be suitable for inferences. Despite that, other factors such as health or family matters may influence performance. Furthermore, the ability level of each student will differ; therefore, it is important for teachers to carry out the preliminary step in identifying students' personalities.

Project	Activities	Indicators (%)	Student A	Student B	Student C
Mini (1-4%)	M1. Take a leaf, draw and label the photosynthetic parts	1			
	M2. Counting heartbeat before, during and after exercise	3			
Trial (5-7%)	T1. Investigate the effect of sunlight on plants	5			
	T2. Investigate the presence of migratory birds	5			
Project (8-10%)	P1. Investigating the succession of plants in secondary forests	9			
	P2. The importance of pitcher plants in heath forest	9			

Fig.2 SBA Evaluation form

The next step is to decide rationally two percentage values: firstly, the benchmark percentage of attainment. For example, if the subject average for a class in the previous test is 45%, and the predicted increase would be a 10% increase, the new benchmark would be 49.5 or 50%. This approach would be useful for teachers who intend to benchmark students statistically (Kelly, 2001). Second, deciding the individual percentage increase to be attained by each student. For example, under the mini-project section, a student participated in observing leaves. The teacher has to decide the weighting of the activity that would contribute to the increase in his or her test results.

If the teacher decided to state at least one percent increase from the previous test, since the activity might be relevant to test questions such as ‘draw and label a photosynthetic leaf’, then a student’s development could be positively evaluated if the attainment increase occurs, assuming that no other factors influenced the results. For example, if a student obtained 50% in his first test and, after completing the mini project, he obtained 50.5% in his second test, this would be evaluated as positive correlation.

However, to make the approach valid, statistical evidence should be obtained by correlating the number of students achieving higher marks to the percentage increase at each section. The evaluation approach should be reliable as three evaluations are gathered: the mini, the trial and the school projects. To avoid other influences, it is better to give assessment just after the projects are completed.

Weighting the activities would probably be the difficult part because a teacher has to decide on this in an unbiased way. The School project would be given the highest percentage weighting since the process of conducting it would affect the whole personality of the student, including such things as confidence, courage and skills, which makes it difficult to measure. Therefore careful consideration must take place in deciding the percentage weighting or indicators (Fig. 2). Kelly (2004) stated that ‘an evaluation system requires an understanding of scaling techniques as well as an understanding of organizations. There are many factors to be considered in the evaluation of a job, but the most important three are: the knowledge required to do the job; the kind of thinking required to solve the problems commonly faced in the job; and the responsibilities assigned to the job. A good evaluation system should not only be able to rank jobs in order of importance, but be able to measure their relative size, in other words, a good evaluation system should be able to measure the *significant difference* between jobs. The focus of job evaluation as a process is on the nature and requirement of a job, not on the skills and characteristics of its incumbent. These three-factor codifications of jobs, each of which can be compared to another with respect to what is considered common to all jobs: know-how, problem solving and accountability.’

Once indicators were identified, evaluating students’ development would be easier: that is, by observing the attainment of students. Teachers may comparatively benchmark students’ performance if necessary by comparing one student’s results to the higher achievers. Comparative benchmarking (Kelly, 2001) may also be conducted between classes (if standardized tests and projects were given to students in each class) by comparing against the best.

Structure of Conducting SBA Tool

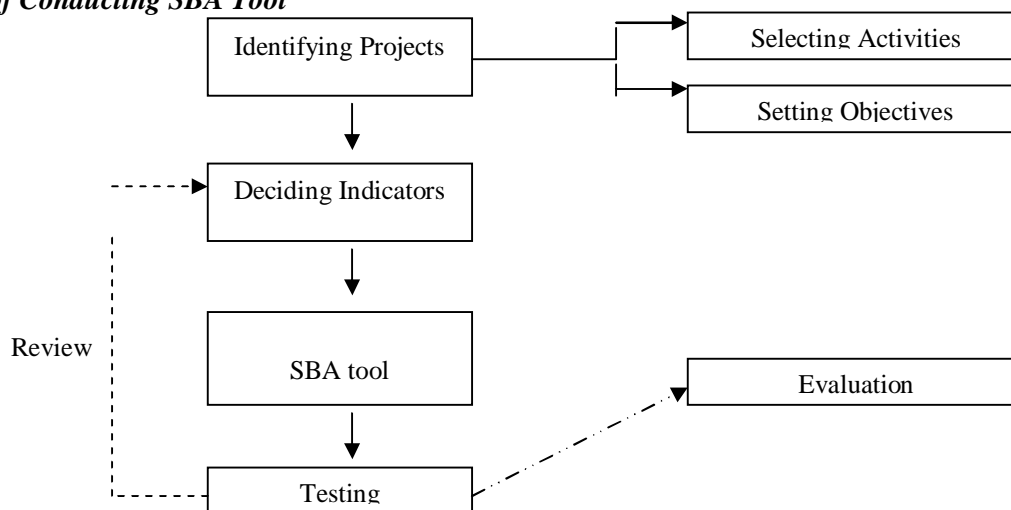


Fig 3: Structure of SBA tool

It is imperative to test the tool before utilizing it with other colleagues. If the design needs improving, adjustments may always be made after testing (Figure 3). Once tested, if it is to be used in more than two classes, teachers needed to decide together on the percentage weighting to avoid misunderstandings, taking into consideration the abilities of each of the classes involved. In this respect, it is therefore important to standardize the percentage weighting or indicators, for example:

- 1) Mini-project: 1 – 4% increase (if previously achieved 50%, the new achievement should be at least 50.5% if using 1% indicator)

- 2) Trial project: 5 – 7% increase (if previously achieved 50%, the new achievement should be at least 52.5% if using 5% indicator)
- 3) School project: 8 – 10% increase (if previously achieved 50%, the new achievement should be at least 54.0% if using 8% indicator)

The indicators used above are only for examples based on low ability students. The indicators range (that is 1% to 10%) is based upon the intended percentage increase for statistical benchmarking.

The student development perceived from each section of school based activities may differ from one objective to another. Dk Hj Siti Fatimah & Cheong (2003) focused a science project on the development of students' inquiry abilities, such that the projects conducted were to solve real problems using scientific and investigative activities. Inquiry strategies included questioning, hypothesizing, experimenting or testing, analysing and drawing conclusions (Trowbridge & Bybee, 1996).

Benefits of Using the SBA Tool

The SBA tool is a new tool that might receive a lot of criticism once utilized publicly. However, its credibility lies in its ability to evaluate the students' development, since it has its specific goals and specific activities. In a school, two departments could be benchmarked comparatively as long as the activities implemented have similar and reasonable weightings utilizing the same indicators for each section (Fig 4).

Project	Equivalent Activities	Indicators (%)	# Students participate		# Students achieved	
			Dept. A	Dept. B	Dept. A	Dept. B
Mini (1-4%)	M1	1				
	M2	3				
Trial (5-7%)	T1	5				
	T2	5				
Project (8-10%)	P1.	9				
	P2	9				

Fig.4 SBA Evaluation for Departments

In a network of schools, once testing of the SBA tool is proven, it can be used to benchmark two schools comparatively. It will also improve interaction between two schools and, indirectly, promote the exchange of information between them. Thus, opportunities for both schools to communicate will induce self-reflection on the SBA tool or any matters concerned. In terms of activities, teachers are free to implement more than indicated and use different activities for different groups of students.

A student's positive development will increase the school's performance academically, socially and aesthetically, since the involvement in activities, particularly ecological activities may result in interactions with other human beings and with the environment. The school climate might also benefit from a positive impact, resulting in a more competitive and learning-conducive environment. Approaches to school improvement (Reynolds *et al.* 1996) for the 1980s are assumed as follows:

- orientation = 'bottom-up'
- knowledge base = practitioner knowledge
- target = process based
- outcomes = school process oriented
- goals = outcomes problematic
- focus = teacher
- methodology of evaluation = qualitative
- site = within school
- focus = whole school

Brown *et al.* (1995) called for research on school effectiveness to focus more closely on classroom processes, accompanying our understanding of differential achievement with a systematic analysis of learning and teaching. Hargreaves (1994) argued that school effectiveness depends most of all on the classroom effectiveness of each teacher. School-based activities start at as simple a level as possible and are classroom-based.

Conclusion

It has always been recognised that school-based activities which are conducive to learning will help students to improve their performance in their assessments and develop them in various ways. Evidently, from experience, the activities initiated had directly or indirectly shown an increase in the development of the school. However, this was not proven statistically. The belief stance of the hypothesis developed here is that there is a direct relationship between the implementation of activities and students' development; such a relationship should show a high significance. Therefore, in order to realize that assumption, the SBA tool was developed. This tool opens up opportunities for future researches to evaluate the significance of this relationship.

In all fairness, the tool must be tested beforehand. The tool would be useful in comparative benchmarking of one student in relation to a high-achieving student. It could also be used for benchmarking within departments, within a school and between schools. However, teachers are advised to agree their own weightings based on the objectives meant for the activities, and the indicator should allow consideration of low-ability students. Two benchmarking indicators, which are interrelated in one sense, could be used in the SBA tool: that is, the intended percentage increase for the whole class and individuals' percentage increases. Benchmarking can be done either statistically or comparatively.

The SBA tool may receive critical responses since it is new; however, there is always room for improvement.

The tool would be reliable since it entailed three repetitions of evaluation on the same group of students: that is, mini-project, trial project and school project. School-based activities help develop students' skills and personalities so as to prepare them for the more advanced levels. For teachers, implementing the tool as a teaching strategy might be perceived as exhausting; however, it can become a means of reflecting excellence in their teaching in a collegial manner (Noble & Pym, 1989). Teachers' reflection as a means of self evaluation is critical for self-improvement and to further develop the potential of the students and the effectiveness of the school. It will also drive the school's intellectual capital (Kelly, 2004), which increases the value of the school in terms of marketing to its clients, the parents, the inspectorates and other concerned officers in the Ministry of Education.

For my school, creating and utilizing this tool would achieve the goal stated by the administrators – particularly the second one, that is to create within the school a meaningful, enjoyable and rewarding learning environment. The teachers, accordingly, were required to recognise and celebrate student achievement and success and to make every effort to provide interesting lessons and course work, while at the same time fulfilling the requirements of the National Curriculum.

Note:

The paper was written in 2004 as one of the author's assignment module in University of Southampton Master course (Institutional Management and Leadership for Professional Development) and graded 'A'. The author was awarded the Foreign Commonwealth Office scholarship (Queen Elizabeth Chevening scholarship) to do Master degree in United Kingdom and left her school; after completing her one – year study, she was assigned to teach in a Science College, one of the prestigious colleges in Brunei Darussalam. One of her students' participating in the Explomaths now becomes her colleagues as a Maths teacher. As mentioned by her former student, 'the author is still my favourite Maths teacher!'

References

- Brown, S., Duffield, J. and Riddell, S (1995) School effectiveness research: the policy makers' tool for school improvement, *European Educational Research Association Bulletin*, 1(1): 6-15. In: MacBeath, J & Mortimore, P (2001). *Improving School Effectiveness*. UK: Open University Press
- Carnell, E. & Lodge, C. (2002) *Supporting Effective Learning*. In: MacBeath, J & Mortimore, P (2001). *Improving School Effectiveness*. UK: Open University Press
- Dalin, P. with Rolff, H.-G. in corporation with Kleekamp, B. (1993) *Changing the school culture*. London: Cassell. In MacBeath, J & Mortimore, P (2001). *Improving School Effectiveness*. UK: Open University Press
- Dk.Hjh. Siti Fatimah, PHP & Cheong, P.A.(2003). *A Teacher's Personal Journey in Using Science Projects*. In: ICASE World Conference 2003, Penang, Malaysia (unpublished).
- Hargreaves, D. (1982) *The Challenge for the Comprehensive School*. London: Routledge & Kegan Paul
- Hargreaves, D. (1994) *Helping Practitioners Explore Their School's Culture*. In Ainscow, M., Hargreaves,, D., Hopkins, D., Black – Hawkins, K. (1994) *Cambridge Manual of Research Techniques – Mapping Change in Schools*. London
- Http 1: http://www.cedu.niu.edu/scied/wb/C-09-01/effective_teaching/sld008.htm
- Kelly, A. (2001) *Benchmarking for School Improvement*. London: Routledge Falmer
- Kelly, A. (2004) *The Intellectual Capital of Schools*. Netherlands: Kluwer Academic Publishers
- MacBeath, J & Mortimore, P (2001). *Improving School Effectiveness*. UK: Open University Press
- MacGilchrist, B, Myers, K. & Reed, J (2004). *The Intelligent School 2nd edition*. London: Sage
- McBer, H. (2000) *Research into Teacher Effectiveness: A Model of Teacher Effectiveness*. DfEE
- MOE Brunei (2004). *Education in Brunei Darussalam*. BSB: Borneo Printers
- Noble, T. & Pym, B. (1989) *Collegial authority and the receding locus of power*. In Bush, T. (Ed) *Managing Education: theory and practice*. Milton Keynes: Open University Press
- O'Brien, B. (1990) *Advanced Maturity*: In Senge, P.M. (1990) *The Fifth Discipline*. London: Random House
- Reynolds, D., Bollen, R., Creemers, B., Hopkins, D., Stoll, L. & Lagerweij, N. (1996). *Making good school: linking school effectiveness and school improvement*. London: Routledge
- Schulman, L. (1987) Knowledge and teaching foundations of the new reform, *Harvard Educational Review*, vol. 57, no.1, pp. 1 – 22. In: MacBeath, J & Mortimore, P (2001). *Improving School Effectiveness*. UK: Open University Press
- Senge, P.M. (1990) *The Fifth Discipline*. London: Random House
- Trowbridge, L.W., & Bybee, R. (1996). *Teaching secondary school science: Strategies for developing scientific literacy*. In: Dk. Hjh Siti Fatimah, PHP & Cheong, P.A. (2003). *A Teacher's Personal Journey in Using Science Projects*. In: ICASE World Conference 2003, Penang, Malaysia (unpublished).