



Improving Students' Understanding In Basic Electronics Through The Lesson Study Approach In Secondary Two Classes

30 Nov 2007

S3P3 (D2-LP-09)

Presenters:

1. Low Swee Hian (low_swee_hian@moe.edu.sg)
2. Clement Lim (lim_jit_hui_clement@moe.edu.sg)



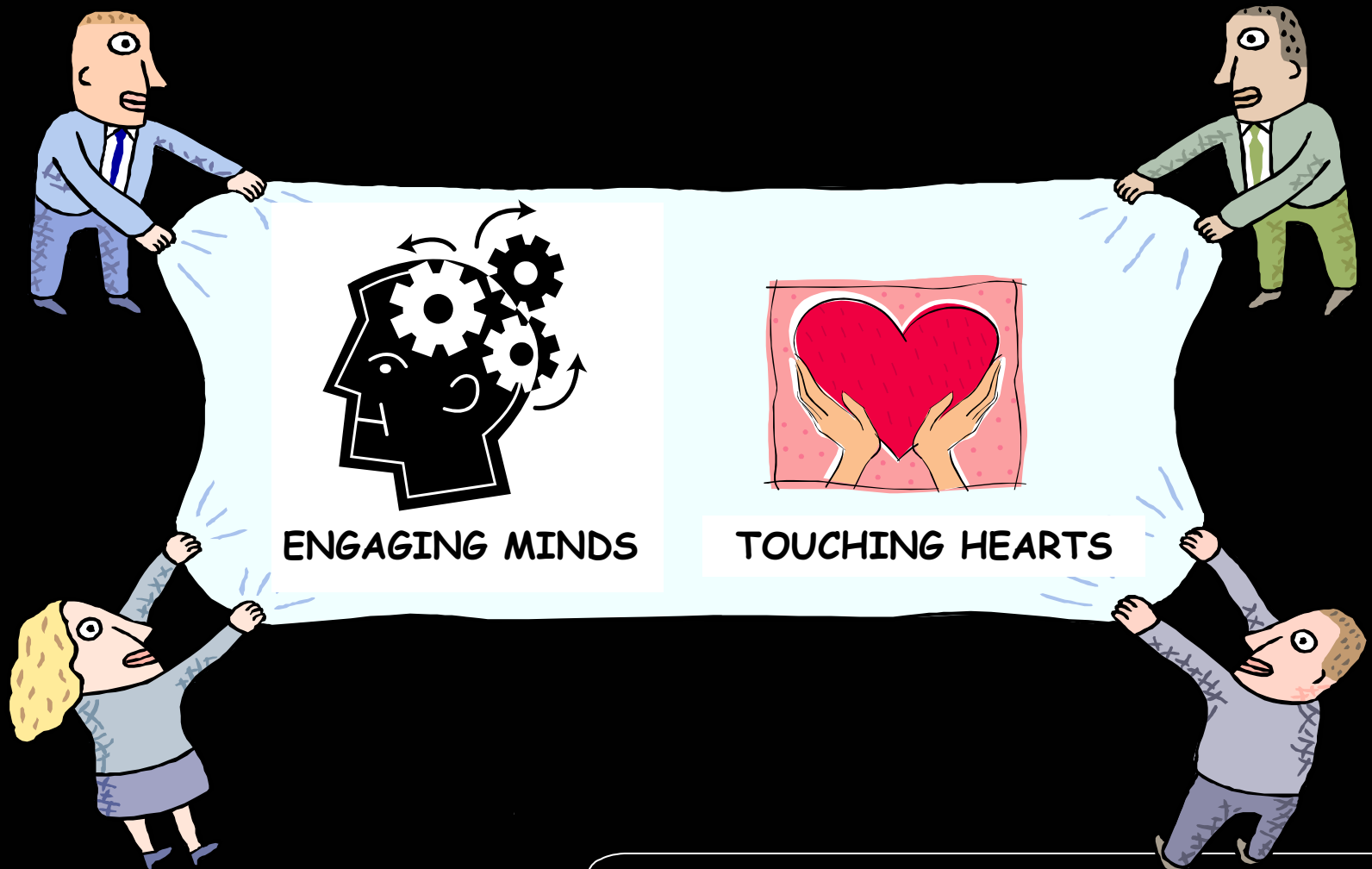
Outline

- a. Why is Lesson Study (LS) adopted and adapted in Bedok South Secondary School (BDS)?
- b. What is BDS Design & Technology (D&T) team's strategy?
- c. How did the D&T team carry out LS?
- d. What are the results and findings?
- e. What are the interpretations that can be drawn and recommendations given?
- f. Question & Answer



a. Why is Lesson Study (LS) adopted and adapted in Bedok South Secondary School (BDS)?

👉 Towards a Learner-centred education



Literature Review

Engaged Learning

- Shernoff, Csikzentmihalyi, Schneider & Shernoff (2003) found that students prefer individual or group work to pure lectures as they have the opportunity to engage with their peers.
- Research carried out by Strong, Silver & Robinson (1995) show that despite being challenged with difficulties and obstacles, engaged students will persist and take visible delight in accomplishing their work.
- An engaging learning curriculum (Devakishen & Low, 2007) that is highly hands-on and interactive can engage students to learn by doing and questioning.



Literature Review

Teaching of D&T-Electronics in Secondary Schools

- Design and Technology (D&T) is one of the most dynamic and fastest growing areas of the contemporary school curriculum in many developed countries (Eggleston, 2001).
- Fernandez, Gaercia & Cobos (2002) believe that most motivated students can learn electronics on their own and without any assistance.
- In Singapore, Poon & Ng (2001) have reported the need for teachers to learn about their students' diverse and heterogeneous learning styles in order for them to deliver effective teaching in D&T lessons.
- Yau (2002) advocates the use of play-and-learn in the teaching of electronics in lower secondary school D&T. His research findings have found that appropriate hands-on practice can promote motivation and knowledge transfer.

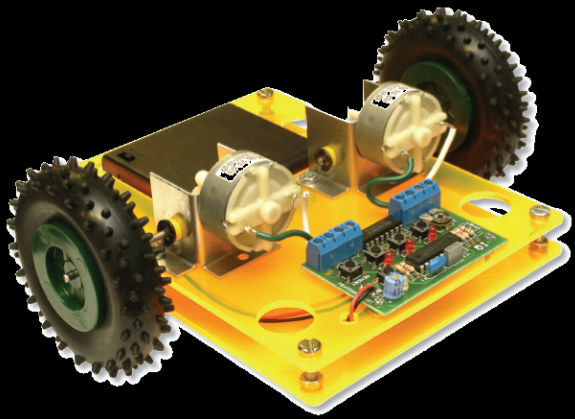


a. Why is Lesson Study (LS) adopted and adapted in Bedok South Secondary School (BDS)?

✌️ Revision in D&T syllabus-
Shift from traditional technical and craft-based education to contemporary design and technology-based education.

✌️ Electronics made compulsory.

✌️ **Real need** to prepare teachers and technicians for the delivery of technology-related lessons



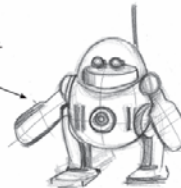
ENGAGING THEM



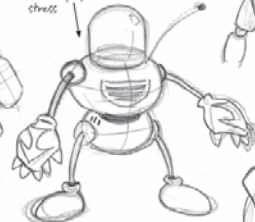
Idea Generation

Bringing together the best ideas.

- curved profile, giving it a cute look.
- limbs are only able to rotate



- 'headless' robot
- appear to have skinny legs
- interchanging of limbs
- curved profile exerts less stress



- majestic look
- complex profile might need G&P casting
- ball-socket joints



- aggressive-looking
- manoeuvrable
- many parts to make and join, might be time-consuming
- able to incorporate different materials



- design inspired by a flying cockroach
- armoured robot looks stiff
- need G&P casting to mould body



A page from a sample design journal



a. Why is Lesson Study (LS) adopted and adapted in Bedok South Secondary School (BDS)?

D&T Team profile



Staff role (No.)	Academic And Professional Training	No. of years of Teaching experience
Team Leader	Civil Engineering, Physics	6
Teacher 1	D&T, Woodcraft	38
Teacher 2	Civil Engineering, D&T	6
Teacher 3	Mechanical Engineering, D&T	Less than 1
Technician 1	Woodcraft and Workshop	23
Technician 2	machining	11
Neutral Observer	Computer Engineering, Basic Robotics	2



b. What is BDS Design & Technology (D&T) team's strategy?

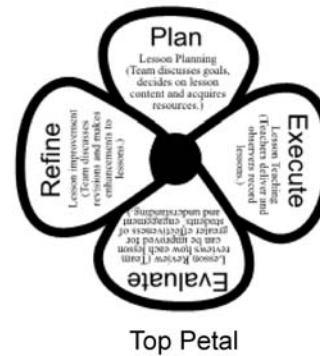
OUR RECOMMENDED STRATEGY

PETALS Framework



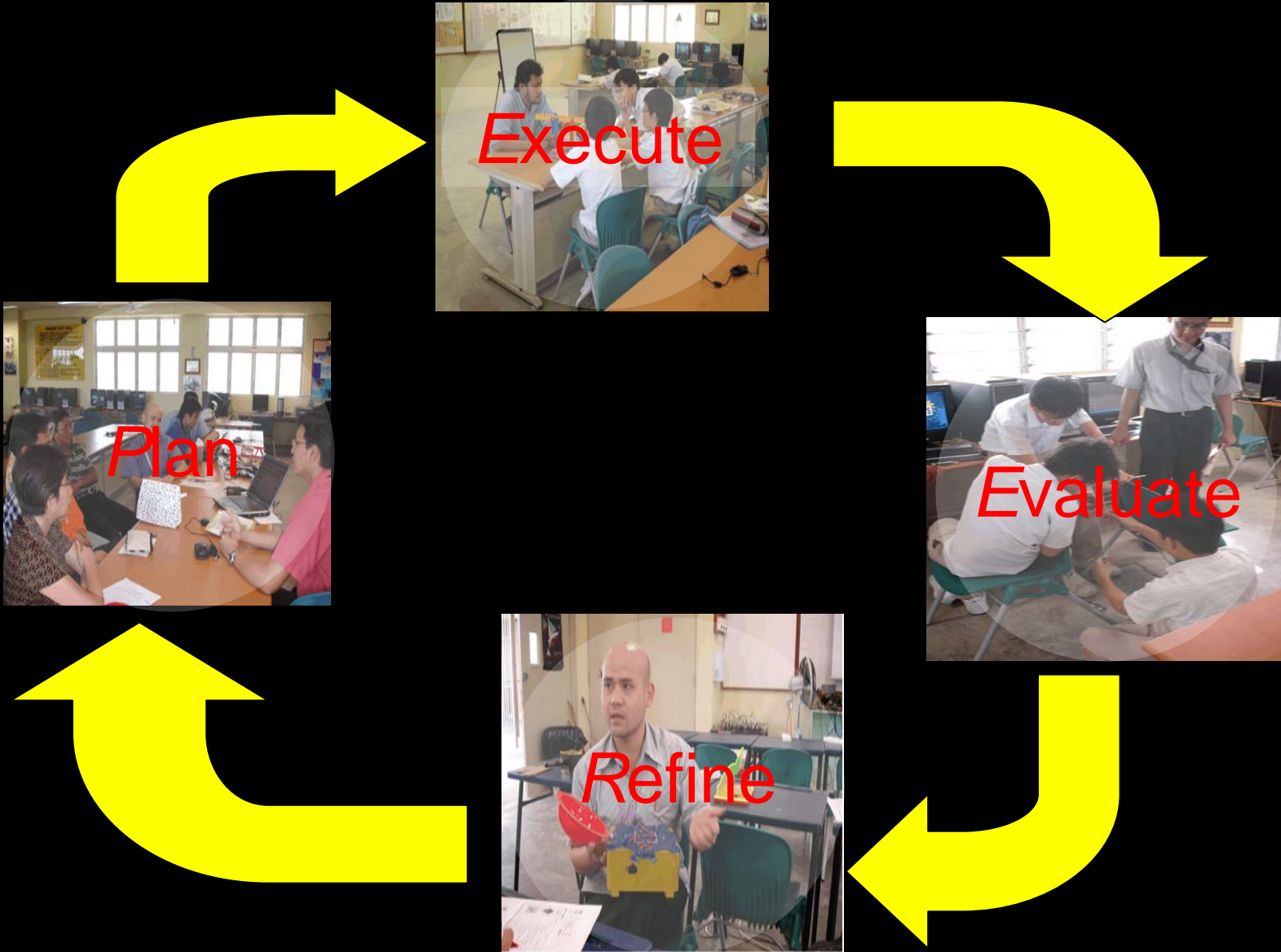
Supportive School Leadership

PEER cycle



b. What is BDS Design & Technology (D&T) team's strategy?

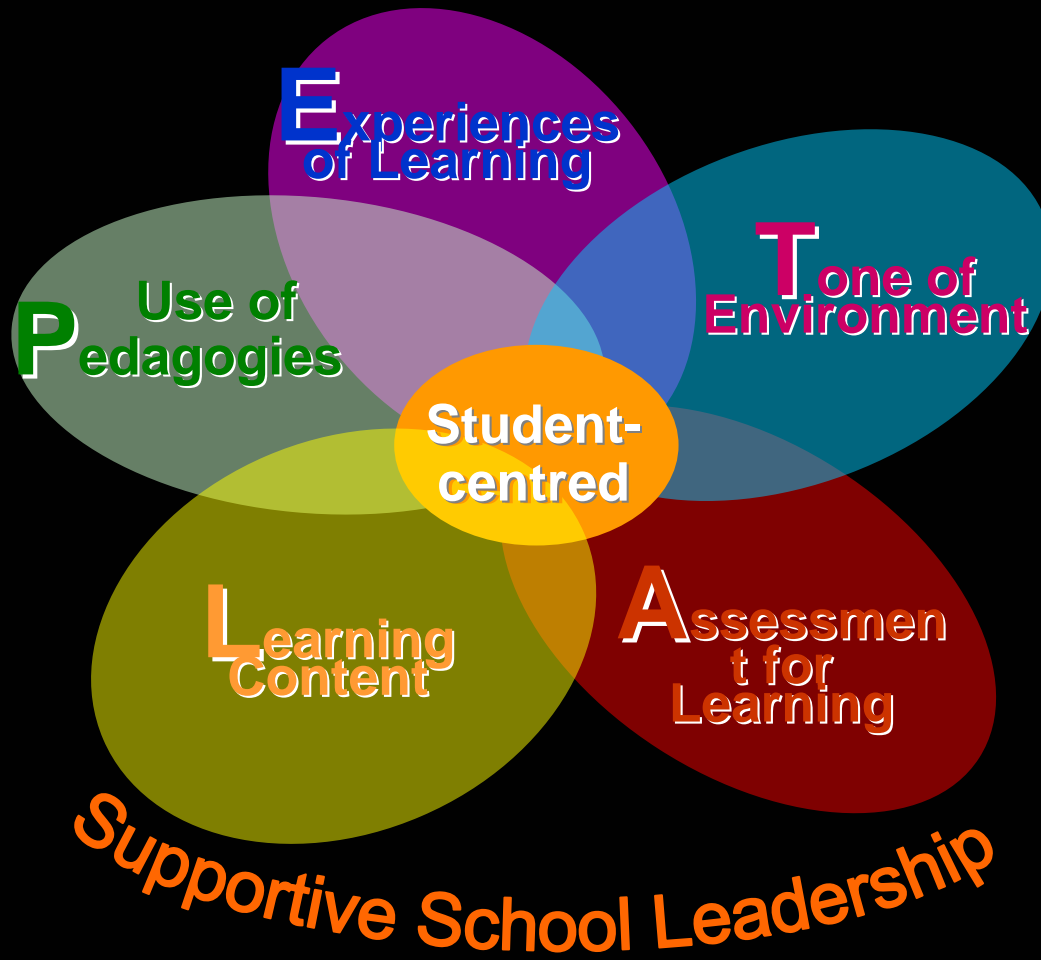
LESSON STUDY



CYCLE : P E E R



b. What is BDS Design & Technology (D&T) team's strategy?

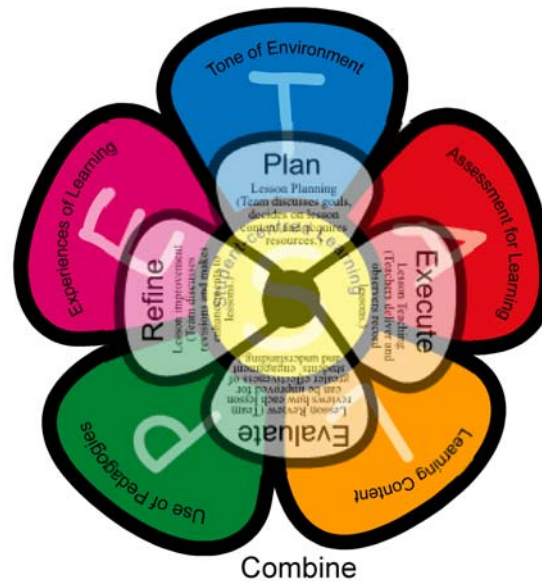


Source: Towards Engaged Learning, A toolkit for Engaged Learning and teaching. Curriculum Planning and Development Division, MOE Singapore



b. What is BDS Design & Technology (D&T) team's strategy?

OUR Recommended STRATEGY



Objectives

1. To 'see' students and identify their misconceptions and difficulties so as to better facilitate their learning.
2. To improve the quality of lessons delivered through progressive enhancement.
3. To encourage staff to work collaboratively as a team to develop and improve curriculum.
4. To build staff confidence so as to promote continuous improvement in teaching and learning that will bring about long-term benefits to students.



Profile of our students

Class(es) / Stream	No. of students	No. of girls	No. of boys
Sec 2A- 2E/ Express (Exp)	197	89	108
Sec 2F-2 H/ Normal Academic (NA)	119	50	69
Sec 2I / Normal Technical (NT)	38	13	25



c. How did the D&T team carry out LS?

	Pedagogies	Experiences	Tone of Environment	Assessment for learning	Learning Content
P I a n	<ul style="list-style-type: none"> ➤ Individual teachers are to deliver the lessons that cater to the varied learning styles of students. These can be in the form of lecture-based and activity-based lessons. ➤ Activity-based lessons include tasks given to students to be completed individually. 	<ul style="list-style-type: none"> ➤ Hands-on sessions are designed and introduced in lessons to allow students to see and assemble for themselves simple circuits. They are slowly challenged with more advanced circuits. The aim is to create a confidence-building experience for students. 	<ul style="list-style-type: none"> ➤ Logistical needs in terms of teaching materials, equipment and tools are prepared to ensure the smooth running of lessons. 	<ul style="list-style-type: none"> ➤ A <u>Pre-test</u> is decided and administered at the beginning of the first lesson to assess students' current understanding and identify their common misconceptions. ➤ Examination and discussion on students' work is done weekly to check on students' understanding. 	<ul style="list-style-type: none"> ➤ Based on the Scheme of Work, the team identifies the main topic and sub-topics to be taught. ➤ Team also considers the authenticity and relevance of the learning content.



c. How did the D&T team carry out LS?

	Pedagogies	Experiences	Tone of Environment	Assessment for learning	Learning Content
E x e c u t e	<p>➤ Observations made during the lessons:</p> <p>Teacher 1: Focused more on the circuits and building up of student confidence.</p> <p>Teacher 2: Focused more on general Electronics knowledge.</p> <p>Teacher 3: Focused more on students' understanding and guiding them step by-step.</p>	<p>➤ Observations made during the lessons:</p> <p>Teacher- student interaction and students' responses are minimal during the lectured-based lessons.</p> <p>Students are most responsive during the hands-on activity based lessons.</p> <p>Introducing the various types of switches in a lecture style is not well received.</p>	<p>➤ Lessons are conducted in a workshop environment.</p> <p>➤ Students attend lessons in a non threatening, conducive environment.</p> <p>➤ Teachers and Technicians establish basic classroom rules with students at the beginning of the first lesson.</p>	<p>➤ The Pre-test and the pieces of class work are examined.</p> <p>Students' class work and home work are returned to allow students to learn from their own mistakes.</p>	<p>➤ Basic electrical components, conductors and insulators are taught.</p> <p>➤ Various types of switches are also taught. Team also highlights the relevance of the various types and functions of switches to students in their lives.</p>



c. How did the D&T team carry out LS?

	Pedagogies	Experiences	Tone of Environment	Assessment for learning	Learning Content
E v a l u a t e	<ul style="list-style-type: none"> ➤ Students' participation and proactiveness in lessons are dependent on various factors: teachers style and group dynamics. ➤ Students' Learning can be enhanced by group activity. 	<ul style="list-style-type: none"> ➤ Hands-on sessions are well-received. Need to factor in more of such sessions. ➤ Learning by interacting as a group can promote better engagement in class. 	<ul style="list-style-type: none"> ➤ Location of equipment has to be labeled clearly to facilitate finding of tools and teaching materials. Teachers and students have difficulty especially during the first lesson. 	<ul style="list-style-type: none"> ➤ Students who make mistakes in their first few attempts in getting their circuits to work could better appreciate the lesson than students who got it right in their first attempt. 	<ul style="list-style-type: none"> ➤ The light sensing circuit is included and heat sensing circuit is used to stretch the higher ability students.



c. How did the D&T team carry out LS?

	Pedagogies	Experiences	Tone of Environment	Assessment for learning	Learning Content
R e f i n e	<ul style="list-style-type: none"> ➤ Team needs to encourage greater student involvement in lessons. One possible way is to engage students through a more inquiry-based approach. ➤ Better understanding of students' group dynamics can enhance the quality of lessons. 	<ul style="list-style-type: none"> ➤ A more structured lesson in terms of giving students their individual activity time, group activity time and whole class discussion time to engage students. ➤ Whole class discussion time highlights the common mistakes made by other students. This encourages students to learn from one another. 	<ul style="list-style-type: none"> ➤ Technicians construct <u>Interactive Switch Board</u> Teaching Aids to facilitate the teaching of switches. ➤ Student-to student rapport is also encouraged through group activities. ➤ Technicians establish rapport with students and teachers as they are always there to assist teachers in helping students 	<ul style="list-style-type: none"> ➤ Teachers do a collective summary to all students to highlight the possible mistakes made by them. This is to ensure that students can learn from one another's mistakes even though they may not commit the mistake themselves. 	<ul style="list-style-type: none"> ➤ The team excludes the heat sensing circuit in the next cycle as the basic principles behind the light and heat sensing circuits are the same.



d. What are the results and findings?

Video(technical)



Results @ 95% confidence. i.e. P-value < 0.05, intervention is significant

Stream	Class	No.	Significant Improvement (P -value)
Exp	2A	41	0.4463
	2B	41	0.2888
	2C	39	0.2398
	2D	38	0.2319
	2E	39	0.0034
NA	2F	40	0.0001
	2G	42	0.0304
	2H	39	0.0344
NT	2I	38	0.0005



Results

@ 95% confidence. i.e. P-value < 0.05, intervention is significant

Stream	Class	No.	P-value Cycle 1	P-value Cycle 2
Exp	2A	41	0.3708	0.2526
	2B	41	0.3176	0.1508
	2C	39	0.0171	0.1508
	2D	38	0.4084	0.0451
	2E	39	0.0698	0.0121
NA	2F	40	0.0050	0.0064
	2G	42	0.1609	0.0350
	2H	39	0.3030	0.0013
NT	2I	38	0.0234	0.0005



e. What are our interpretations of the results ?

- **No significant improvement** in the performance of the **higher ability (Express stream)** -1 out of the 5 Exp classes.
- **Significant improvement** in the performance of the **middle and low ability (Normal Academic and Normal Technical streams)** – all 3 classes of NA and 1 class of NT
- Generally, **more significant improvement** is achieved for Cycle 2. – 6 out of 9 classes.



e. What conclusions can be drawn?

- For the **express (higher ability) stream**, students **may still do well even if their engagement level is lower**. Implying their motivation to do well does not hinge mainly on engagement level.
- For the **NA (middle ability) and NT (lower ability) stream**, there is a **stronger need to ensure engagement through refinement** of curriculum as there is a significant improvement in their academic performance.



Students will understand that success can be achieved, and that failure, is a meaningful lesson learnt. - Neutral Observer

We know the importance of PETALS© but how to apply these aspects is one major concern. Lesson Study offers us one way of doing so.

- Team Leader

I am now kept in the loop of the course requirements. I can see for myself how the work I prepared is being used in class. I have a better sense of the problems faced by students and teachers if the teaching materials that I made are not effective. – Technician 2

Checks can now be made to help clarify doubts and fine-tune lessons. We can now leverage on one another's strengths which in the long-run saves us time and energy. - Teacher with 38 years of experience.

*Lesson Study allows me to explore methods of teaching with other teachers as well as observe the learning experiences of students
- Beginning teacher*





Vision: A value-added quality School

Mission: To nurture our students to be **self motivated, responsible, self-reliant and thinking individuals** who can contribute effectively to society and face all challenges with courage and confidence

Bedok South Secondary School

1980 - established

2003 - moved to new premises

Enrolment : 1520

