How ‘learning study’ enhances teacher learning to implement learner centered instruction in secondary schools

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Organization

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- Theoretical Context
- Study Design
- Findings
- Conclusions

Introduction

- There have been variations in the understanding, focus and implementation of Learner Centred Instruction (LCI) across the world.
  - LCI as consisting of methodological orientation-participatory methods (Lea *et al*, 2003);
  - LCI as transformation of responsibility from the teacher to learners (Jeffrey *et al*, 2009);
  - LCI as fulfillment of student-based needs in curriculum (O'Neil & McMahon, 2005);
  - And LCI as engaging learners in discerning critical aspects of the object of learning (Msonde, 2009). This was premised on the principle of intentionality (Marton & Booth, 1997) that LCI intends to bring about student learning something-the object of learning.

Introduction (Cont'd)

- Since the inception of LCI in education reforms, classroom instruction has remained mainly traditional in many countries across the world Tanzania inclusive(Watts & Becker, 2008).
- Teacher educators in many African countries while acknowledging the worthiness of LCI innovation rarely apply it in their own teaching.
- large classes, inadequate instructional resources to support teachers and students, and overloaded teachers are predominant in developing countries (Msonde, 2011).
- Inadequate knowledge and skills concerning LCI among teachers.

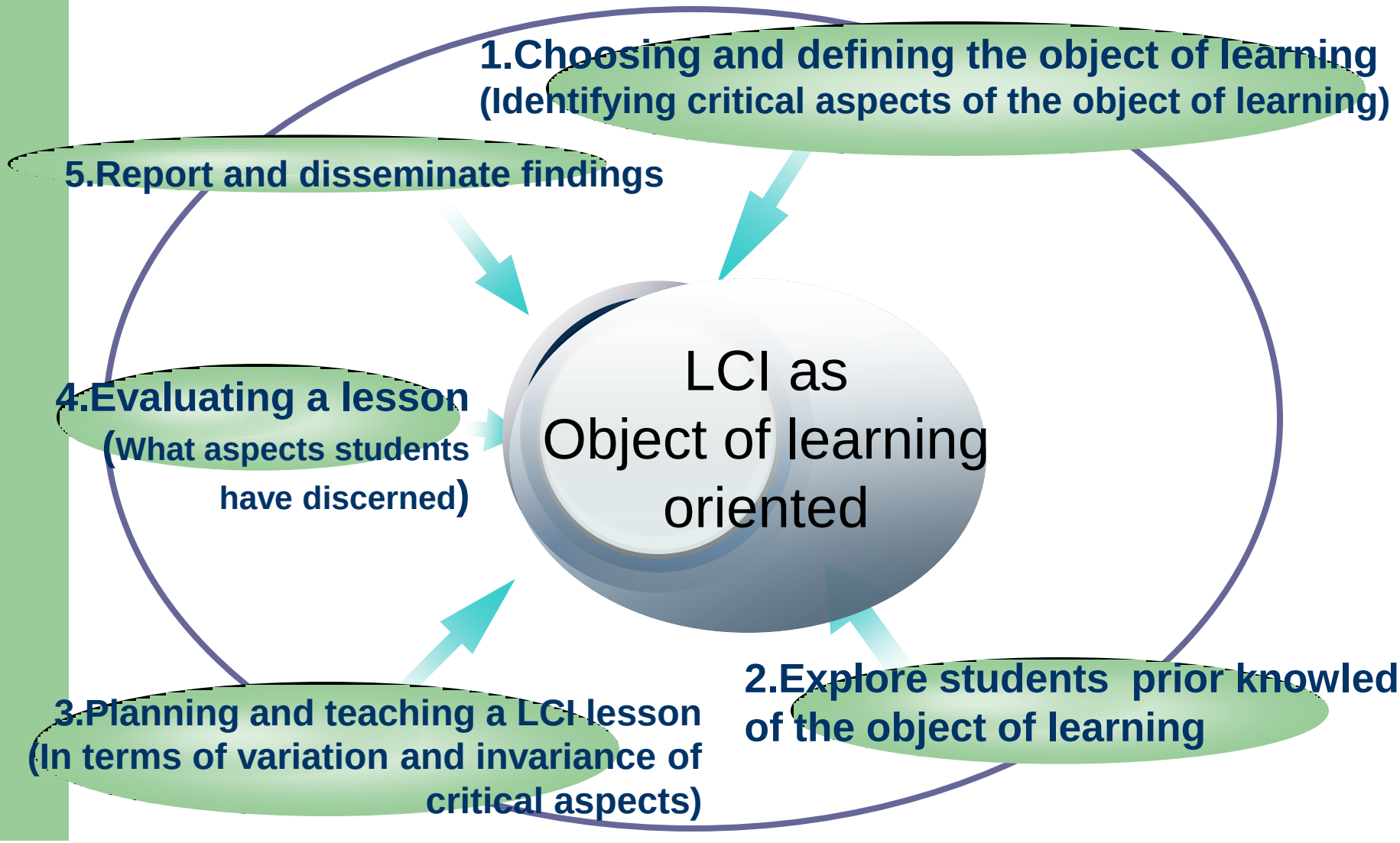
Reflections

- Teachers orientation on LCI was not comprehensive and LCI is conceived mainly as participatory methods (Osaki, 2001; Chediel, 2004).
- The introduction and orientation on LCA innovation did not consider teachers experiences and school realities (Meena, 2004; Msonde, 2006).
- The use of Learning Study (a School-based TPD) to improve teachers ways of implementing LCI in their school realities has shown encouraging results in many countries, eg. China, Hong Kong, Sweden, UK(Holmqvist, 2010; Lo *etal*, 2005; Pang, 2006).

Theoretical context

- Learning Study is a designed experiment grounded in 'variation theory' that aims at making student as well as teacher learning possible.
- It aims at pooling teachers' valuable experiences in one or a series of research lessons to improve teaching and learning.
- The primary focus is on how teaching in LCI engages students in discerning critical aspects of the object of learning.
- The object of learning is the capability that a student is expected to develop after a lesson
- A learning study cycle comprises five steps

A Learning Study cycle



The Variation theory

- Variation theory is built from the phenomenographic perspective that different people conceive of the same phenomenon differently (Marton & Booth, 1997).
- These differences are due to the variations among individuals in experiencing critical aspects of a particular phenomenon.
- To learn a phenomenon (object of learning), one should discern critical aspects of that phenomenon (object of learning), but discernment of those critical aspects is possible when they vary at the same time.
- learning is a function of discernment, variation and simultaneity. Learning is ability to differentiate the critical aspects of the object of learning.

The Purpose of the study

The Study Explored how learning study could improve teachers' learning to implement LCI in bringing about student learning the object of learning

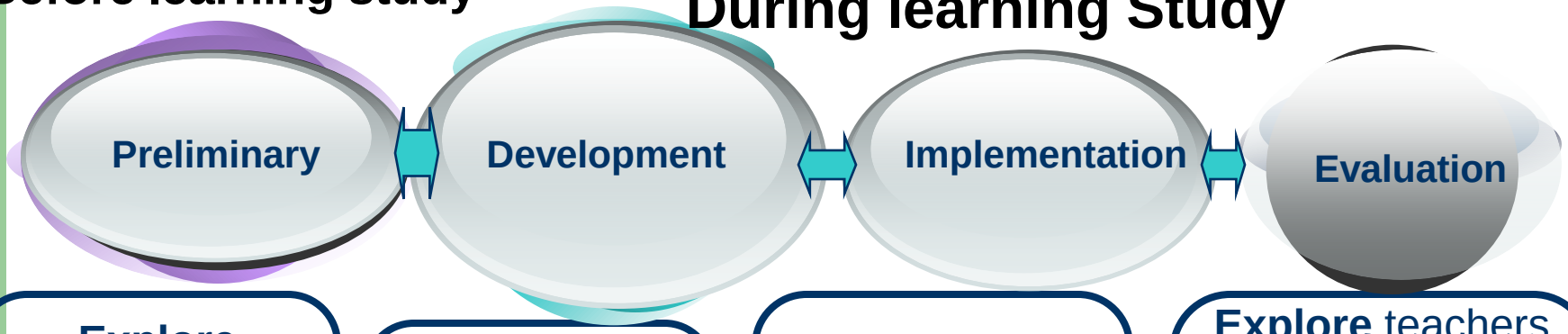
Study Design

- The study investigate 3 mathematics teachers' ways of implementing LCI in two phases-before and during learning study rounds in a community secondary school in Tanzania.
- The community schools were likely to have large classes, inadequate resources, and teacher's high workload; and they comprise a large proportion (97%) of secondary schools (BEST, 2008).
- First, teachers were interviewed. Later, the teachers formed a learning study group and implemented six learning study rounds (one lesson in each round) lasting one year.

Study Design (Cont'd)

Before learning study

During learning Study



Explore teacher's prior understanding and practicing of LCI

(Interview teachers and analyze their foci before learning study)

Use variation framework

Perform two-day workshop on learning study and variation theory

Development of teachers' LCI framework

Implement six learning study cycles (C1, C2, C3, C4, C5, & C6)

Audio/video recording of lesson preparation meetings and C/R teaching

Explore teachers understanding and practicing LCI

(Analyze teachers' foci in lesson preparation and teaching -the intended, enacted and lived object of learning)

Use variation framework and SPSS for students' tests

Results:
Implementation of LCI before learning study

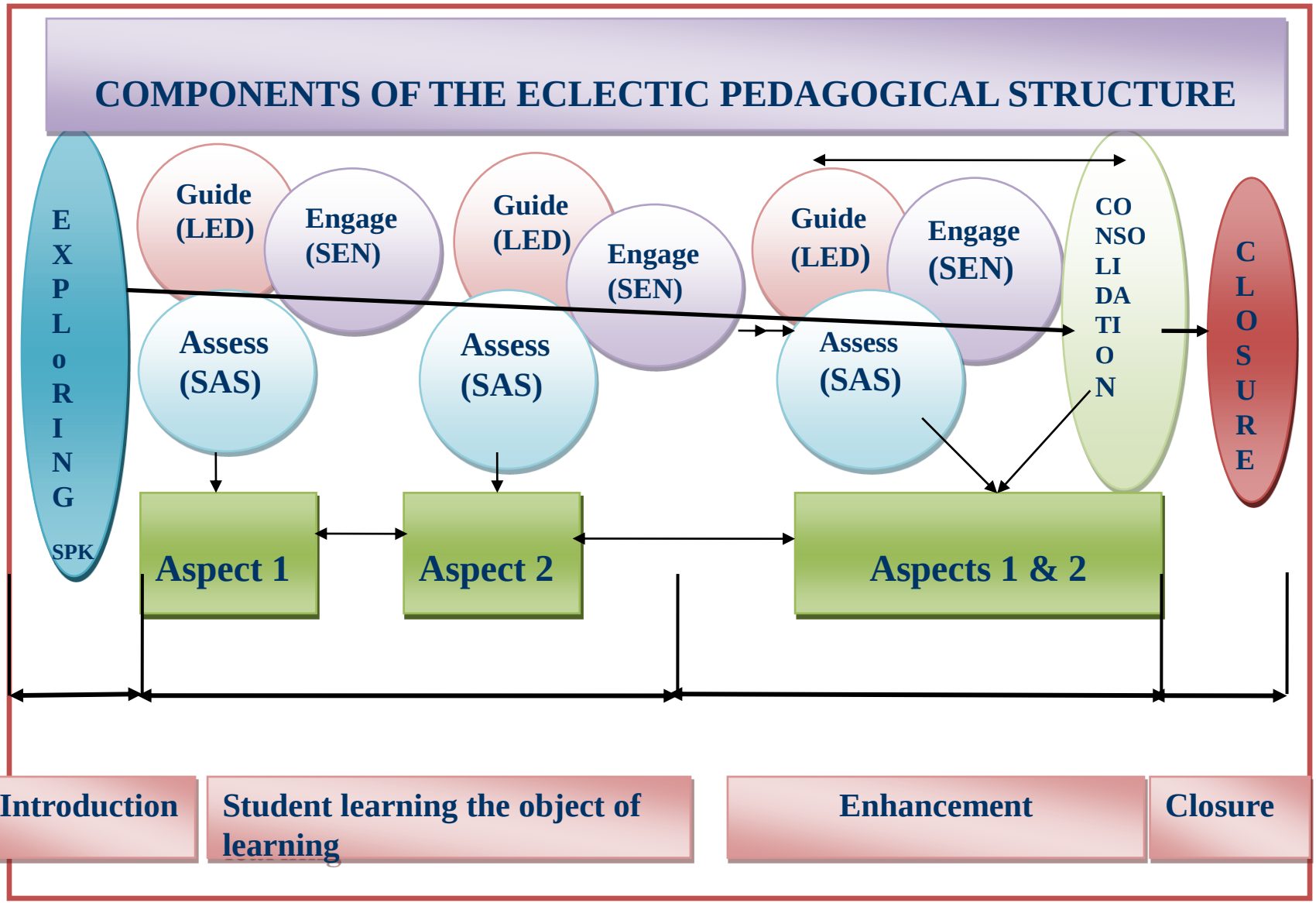
- Teachers saw LCI as methodological oriented (participatory methods) that a teacher should employ to enhance student participation in teaching and learning transactions.
- However, teachers admitted that they rarely applied participatory methods due to formidable constraints prevailing in the classrooms (large classes, inadequate resources, teacher's high workload, cultural orientation).
- Teachers were not very clear about how and what students should learn in these collaborative groups or through participatory instructions; as well as about how the subject content could be handled for students to learn.

Results: Implementing LSA (lesson1)

The intended object of learning (lesson planning)

- Teachers used their knowledge of variation theory to figure out how to involve a student in discerning critical aspects of the object of learning.
- They developed the LCI framework to guide their teaching in the prevailing school environment.
- The learning object was “relationship between sides of right triangle and trigonometric ratios” for form II students (N=255).
- They designed, administered, and marked the pretest to explore students prior experiences.
- Through their experiences, they identified *directional*, *perpendicularity*, *length*, and *relational sides* as critical aspects for student learning trigonometric ratios (But, they did not create dimensions of variation).

LCI Framework



The intended object of learning of lesson 1

Stage	Teacher's intended deliberations
1.Introduction	Introducing types of triangles, including right triangle using diagrams on the board
2. Presentation	(i) Guiding students to unfold directional (opposite), perpendicularity (adjacent), longest (hypotenuse) sides in a right triangle by drawing and using right triangle figures on the board. (ii) Guiding students to derive SOTOCA/HAH mathematical convention, and enable them to use the formula in computing sine, cosine, and tangent of an angle by using three similar right triangles with the focus to angle 30 (use a sheet designed). (ii) Guiding students in applying sine, cosine, and tangent of an angle to estimate height, width, and length in various scenarios (trees, rivers, walls).
3.Consolidation	Summarizing the lesson taught and provides homework.
4. Closure	Unfolding the next lesson about the concept of slope

Enacted object of learning of lesson 1

Stage	Teacher's enactments (They created patterns of variation intuitively)	Angle position	Triangle Orientation	Angle size	Impact on opposite, adjacent & hypotenuse sides/ sine, cosine, and tangent of an angle	Godfrey	Frank	Enock
1	Drew right triangle, varied the angle position and kept the triangle orientation invariant. He asked students to identify the opposite, adjacent and hypotenuse sides.	V	I	-	V	✓	✓	✓
2	Drew right triangle, varied the triangle orientation and kept the angle position invariant. He asked students to identify the opposite, adjacent and hypotenuse sides.	I	V	-	V	✓	✓	✓
3	Guided student to identify opposite, adjacent and hypotenuse sides by varying the angle position and triangle orientation simultaneously.	V	V	-	V	✓	✓	✓
4	Drew right triangle, varied the triangle size (similar triangles) and kept the angle size invariant (30^0). Guided students to derive trigonometric ratios' conventions.	-	V	I	V	✓	✓	✓
5	He guided students to draw 2 triangles from the word problems, which varied in their orientations and angle sizes in estimating height of tree and the ladder using tangent and sine **unknowingly**.	-	V	V	V	x	✓	X

Lived Object of learning

Class	Lesson 1	Mean	N	Std. Deviation	Std. Error Mean	t	Sig. P<0.05
2A	PRETEST1	10.588	85	13.8033	1.4972	-14.237	.000
	POSTTEST1	42.694	85	25.2006	2.7334		
2B	PRETEST1	9.741	85	11.8905	1.2897	-12.568	.000
	POSTTEST1	41.282	85	25.1962	2.7329		
2C	PRETEST 1	8.859	85	9.4958	1.0300	-19.728	.000
	POSTTEST 1	44.624	85	20.1021	2.1804		

Comparison of students learning outcomes among classes in lesson 1

Test	Paired classes	Paired Differences: Mean	Std. deviation	Std. Error Mean	95% Confidence Interval of the Difference: Lower	Upper	t	df	Sig. (2-tailed) P>0.05
Posttest 1	2A-2B	1.4118	32.3104	3.5046	-5.5574	8.3809	.403	84	.688
	2A-2C	-1.9294	29.8340	3.2359	-8.3645	4.5056	-.596	84	.553
	2B-2C	-3.3412	33.8180	3.6681	-10.6355	3.9532	-.911	84	.365

Lived object of learning (Cont'd)

Student understandings in various questions

Understanding in various questions		Class 2A (N=85)		Class 2B (N=85)		Class 2C(N=85)	
		Pretest (f)	Posttest (f)	Pretest (f)	Posttest (f)	Pretest (f)	Posttest (f)
Sides of a right triangle (opposite, adjacent, and hypotenuse) **Q. 1 (24 points)**	High	8	35	10	47	8	52
	Moderate	21	33	17	23	20	23
	Low	56	17	58	15	57	10
Computation of trigonometric ratios (sine, cosine, and tangent)-**Q.2 (36 points**)	High	7	37	9	40	9	44
	Moderate	14	23	11	7	15	23
	Low	64	25	65	38	61	18
Application of trigonometric ratios in their context **Q.3 (40 points**)	High	4	30	5	32	4	31
	Moderate	8	15	6	8	11	14
	Low	73	40	74	45	70	40

Reflections on lesson 1

- Teachers were focused more on the components of the content (how opposite, adjacent & hypotenuse sides informs sine, cosine & tangent of an angle θ) than on the method(s).
- Their primary concern was how a student could discern right triangle sides (opposite, adjacent, and hypotenuse) as well as compute and apply trigonometric ratios (sine, cosine and tangent).
- Intuitively, teachers varied the angle position and triangle orientation aspects separately and simultaneously, which probably enabled students to experience the opposite, adjacent and hypotenuse sides (question 1) better than computing and applying trigonometric ratios (questions 2 & 3).

Implementing LSF (lesson 6)

- Teachers selected the object of learning, “determinants of arc length of circular objects” for form III students (N=240).
- Teachers’ designed, administered, and marked the pretest to explore students’ prior experiences of this object of learning.
- From students’ responses, the teachers identified two critical aspects to focus on: the central angle and the radius.
- Teachers designed patterns of variation and invariance of the radius and central angle aspects in the intended object of learning.

The intended object of learning of lesson 6

Stage	Teachers intended activities	Central	radius	Arc length
1	Guide students to draw a pair of equal circles (in size), insert two radii that subtend equal central angle, measure the resultant arc length and discus the results.	I	I	I
2	Guide students to draw a pair of equal circles (in size), insert two radii that subtend unequal central angle, measure the resultant arc length and discus the results.	V	I	V
3	Guide students to draw a pair of unequal circles (in size), insert two radii that subtend equal central angle, measure the resultant arc length and discus the results.	I	V	V
4	Guide students to draw a pair of unequal circles (in size), insert two radii that subtend unequal central angle, measure the resultant arc length and discus the results.	V	V	V

Enacted object of learning of lesson 6

Cases	Teachers' lesson deliberations	Central angle	Radius	Effect to arc length	Godfrey	Frank	Enock
1	Engaged students (pair groups) in drawing two equal circle, set up equal central angles, measure resultant arc length, present and discuss the results (**Intentionally done**)	I	I	I	✓	x	✓
2	Engaged students (pair groups) in drawing two equal circle, set up different central angles, measure resultant arc length, present and discuss the results (**Intentionally done**)	V	I	V	✓	✓	✓
3	Engaged students (pair groups) in drawing two different circle, set up equal central angles, measure resultant arc length, present and discuss the results (**Intentionally done**)	I	V	V	✓	✓	✓
4	Engaged students (pair groups) in drawing two different circle, set up different central angles, measure resultant arc length, present and discuss results (**Intentionally done**)	V	V	V	✓	x	X

Lived object of learning of lesson 6

Class	Lesson 3	Mean	N	Std. Deviation	Std. Error Mean	t	Sig. (p<0.05)
3A	PRETEST	24.64	80	15.810	1.768	-14.687	.000
	POSTTEST	56.86	80	26.917	3.009		
3B	PRETEST	24.30	80	15.184	1.698	-9.238	.000
	POSTTEST	45.70	80	27.107	3.031		
3C	PRETEST	24.738	80	18.6111	2.0808	-11.188	.000
	POSTTEST	50.300	80	28.7835	3.2181		

Comparison of students learning outcomes in different classes in lesson 6

Test	Paired classes	Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Posttest 2	3A-3B	11.1625	35.0032	3.9135	3.3729	18.9521	2.852	79	.006*
	3A-3C	6.5625	39.4050	4.4056	-2.2067	15.3317	1.490	79	.140
	3B-3C	-4.6000	42.7964	4.7848	-14.1239	4.9239	-.961	79	.339

Lived object of learning (Cont'd)

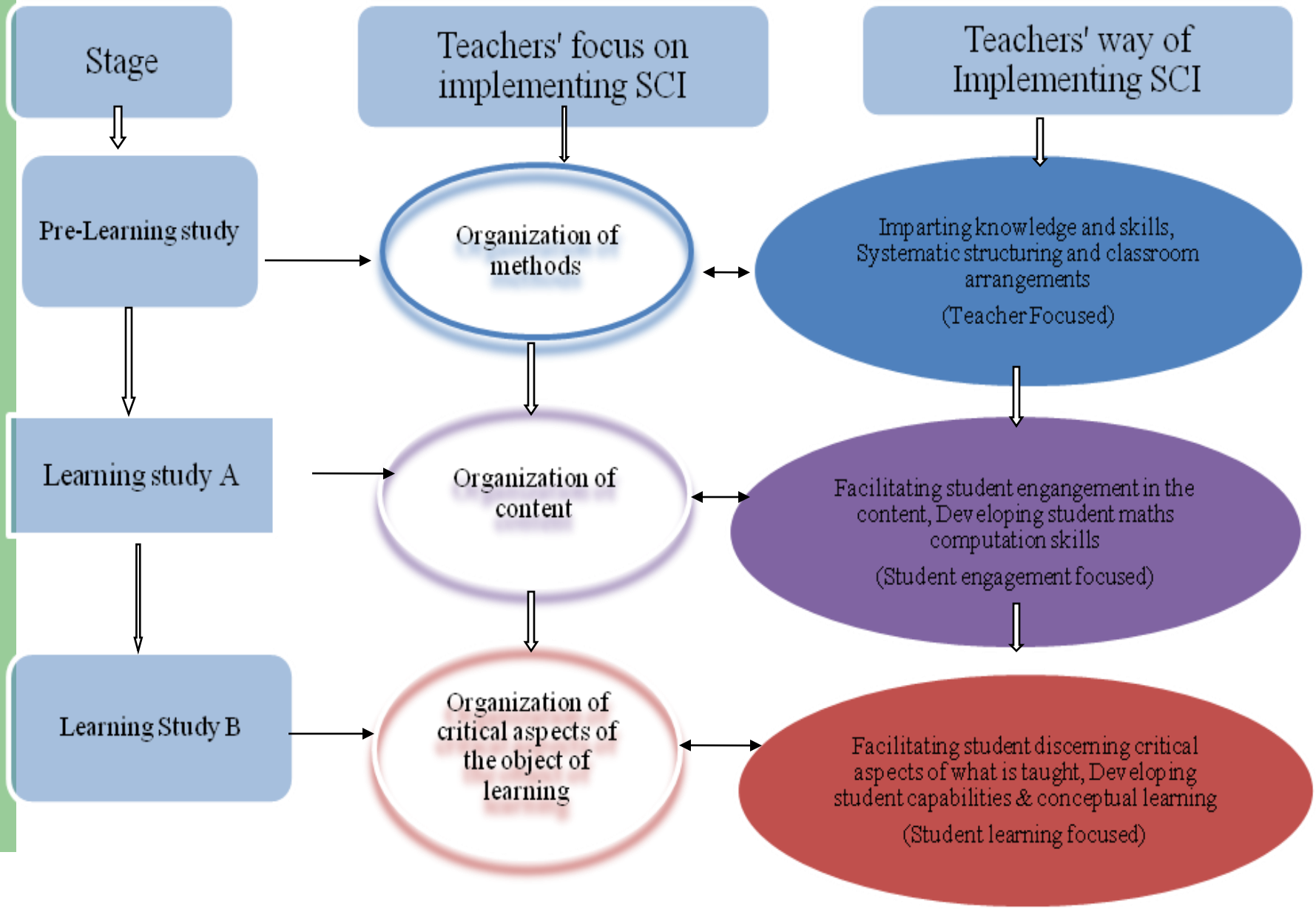
Students' experiencing of and ability to compute arc length

Experiencing determinants of arc length	Class 3A Pretest (f)	Class 3A Posttest (f)	Class 3B Pretest (f)	Class 3B Posttest (f)	Class 3C Pretest (f)	Class 3C Posttest (f)
The change in central angle	22	19	20	16	26	19
The change in radius	10	10	12	7	8	12
The change in both the radius and central angle	8	34	6	24	4	27
Circle area, circumference (uncritical aspects)	17	7	16	12	17	10
Unclassified/not filled	23	10	26	21	25	12
Computation skills & applications	**Class 3A**		**Class 3B**		**Class 3C**	
Able to calculate arc length correctly	15	23	14	13	19	20
Able to perform application question	10	5	9	11	6	6
Able to calculate and apply the arc length	7	36	4	20	8	30
Unable to compute and apply arc length	48	16	53	36	47	24

Reflections on lesson 6

- The intended and enacted object of learning was not exactly the same in all classes, although Godfrey followed the lesson plan very closely.
- He involved students in attending to the central angle and radius aspects separately and simultaneously in experiencing the arc length in class 3A (N=80), but Frank and Enock involved them separately (and partially simultaneously).
- The number of students who discerned both the central angle and the radius in experiencing the arc length seemed to increase considerably in all classes in the posttest (Though class 3A outperformed classes 3B and 3C).

Teachers' ways of Implementing LCI



Summary of the findings

- Teachers involved in the three learning studies changed their understanding of LCI.

methodological-content-object of learning oriented.

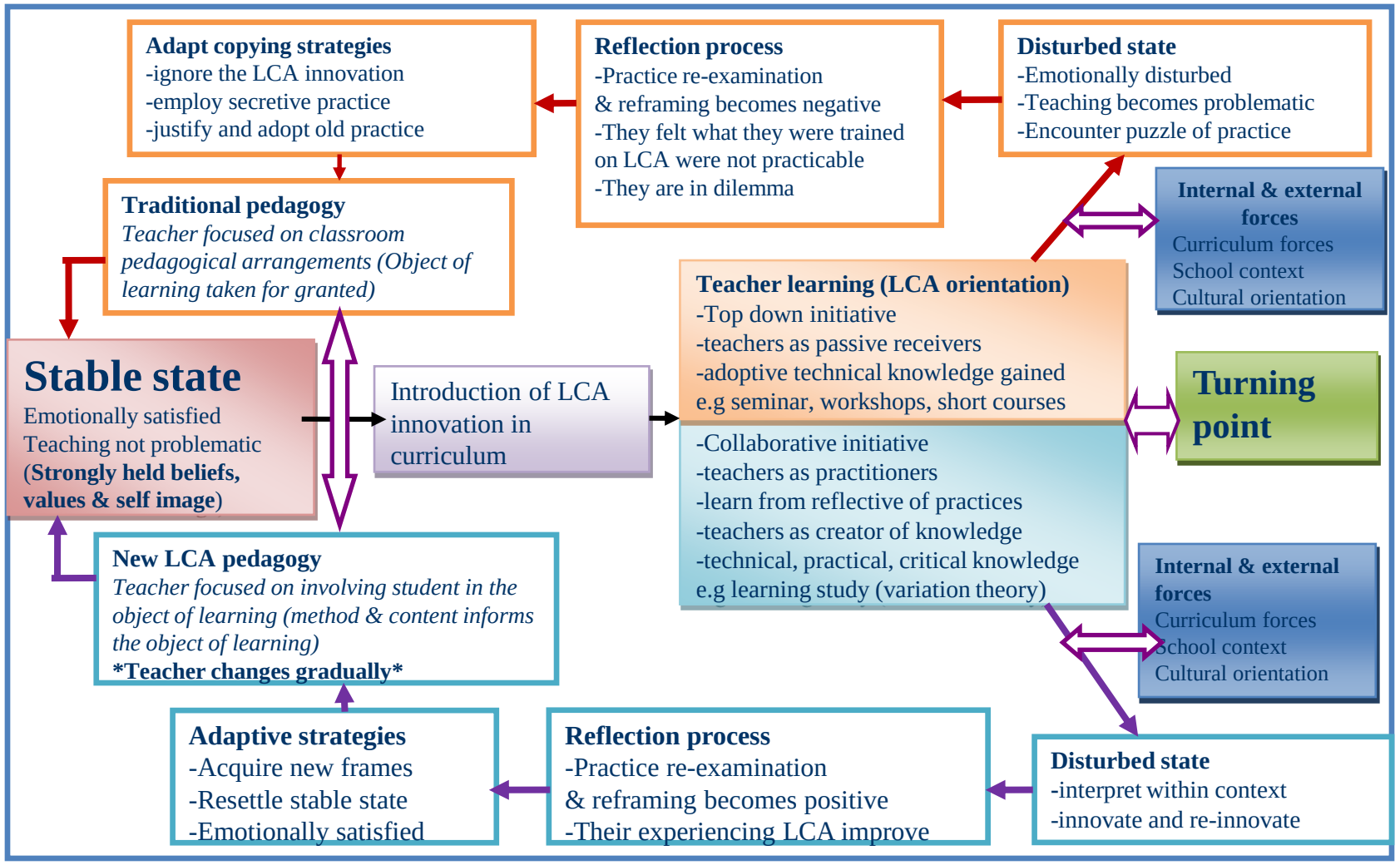
- Guided by the variation theory through learning studies, teachers capability to implement LCI improved progressively in a different ways, which in turn improved student learning. From Making classroom pedagogical arrangement to engaging the learners in either the content or in discerning the critical aspects of the object of learning.
- Teachers changes were gradual and differed slightly depending on the particular aspect(s) (the method, the content or the object of learning) a teacher focused more on than other aspects at a given time.

Conclusions

- Implementing learning study-guided by the variation theory-may be effective in enhancing teachers ways of conceiving and practicing LCI with a primary focus on student learning.
- As teachers increase their understanding of learning study and the use of the variation theory they may advance their understanding in designing and teaching LCI lessons, thereby increasing possibilities for student learning.

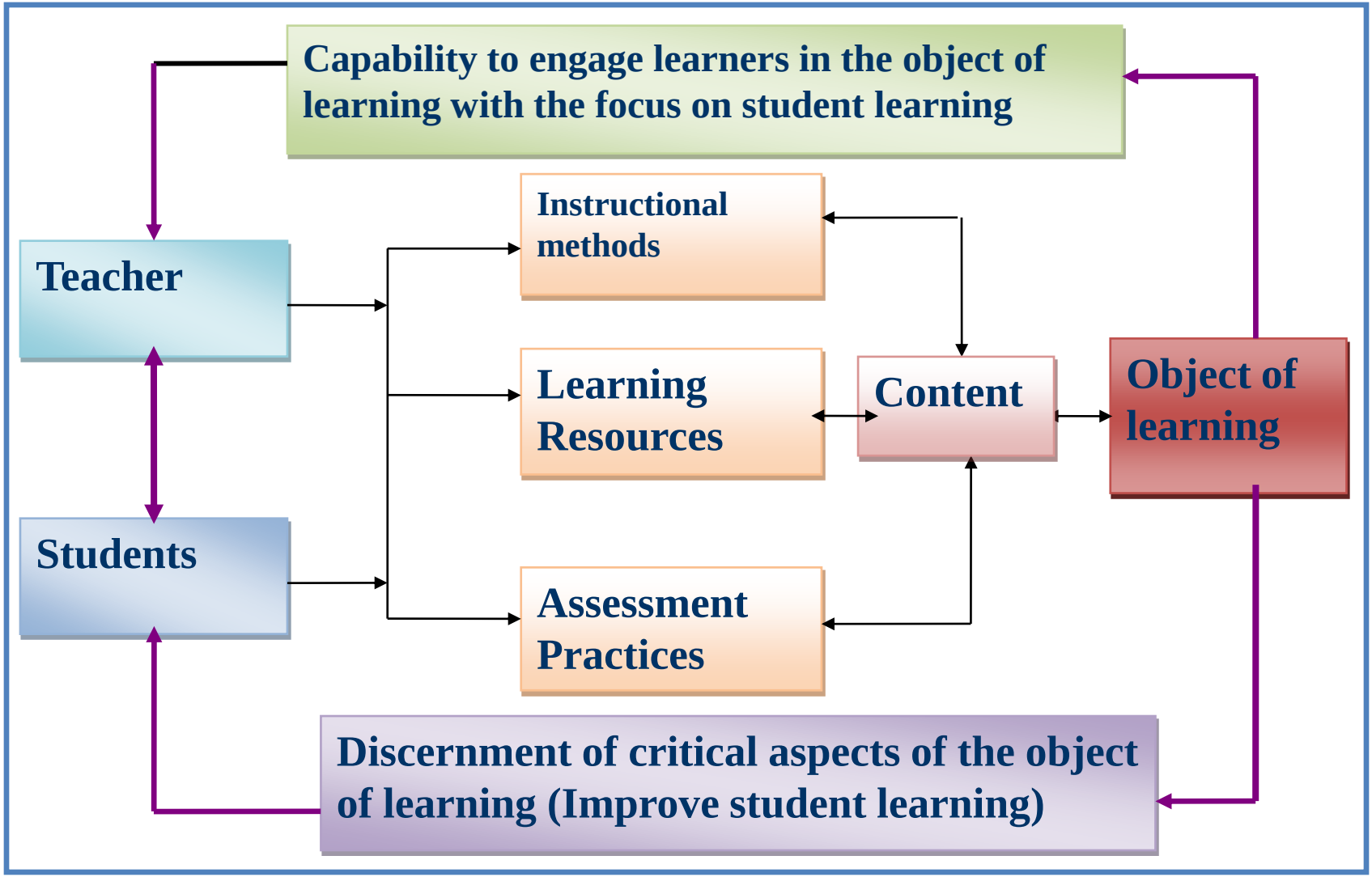
Significance of the study

(a) Teacher learning cycles in adapting the LCI innovation



Significance (Cont'd)

(b) Conceptual framework for implementing LCI



The End

Thank you!