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Process Variables as Determinants of Mathematics Continuous Assessment Practice in Senior Secondary Schools in South West Nigeria

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Abstract:

Assessment has the potential to enhance Mathematics learning and to promote student's interest in mathematics. In order to evaluate the new educational system, one policy that cuts across all educational levels throughout Nigeria is that on Continuous assessment which is enquiring into the learner's competence, knowledge, attitude and skill through various student profile using different assessment methods to improve mathematics learning and performance. The study examined process variables as determinant of mathematics continuous assessment practice in senior secondary schools in South West Nigeria. It attempted to find out the path coefficients of process variables and their relative contribution to the practice of continuous assessment in mathematics in senior secondary schools. The sample consisted of 300 stratified random selected mathematics teachers from senior secondary schools from 60 randomly selected senior secondary schools in South West Nigeria. Data collected was through self constructed questionnaire centred on process variables and mathematics continuous assessment practice (cognitive, affective and psychomotor domains). Result shows that the continuous assessment practice in the school system is based mainly on the assessment of cognitive domain. Teachers do not factor affective and psychomotor domains to the overall performance of the students.

1. Introduction

Assessment plays a significant role in the educational development of a person and of course a nation. It is a means of quality control of determining the level of accountability displayed by stakeholders in the industry and also that determining the effectiveness of teaching and learning, as well as in finding out students' achievement (Henry, 2011). It is a vital tool for educational evaluation that its importance as a quality assurance tool cannot be overemphasised. Hence, continuous assessment is a process or method of finding out what the learner has gained from learning activities in terms of thinking, reasoning and knowledge. According to Yoloye (1984), this is a mechanism whereby the final grading of student in cognitive, affective and psychomotor (Mind-Heart- Hand) domains of behaviour systematically takes into account of all his performances, in test, assignment, projects and other educational activities during a given period of schooling. Cognitive domain relates to the capacity to study or one's mental skills as originally defined by Bloom (1956) and revised by Anderson (2001). The affective domain is all about emotions and feelings especially in relation to a set value (Abera, 2012). Psychomotor domain on the other hand it concerned with the mastery of physical skills ranging from reflexive movement to exhibiting appropriate body language (Harrow 1972 in Abera (2012)). Comprehensive of continuous assessment means that it is not focused on academic skills alone. It embraces the cognitive, the affective and the psychomotor domains. A child is assessed as a total entity using all the psychometric devices such as tests and non test techniques.

Some teachers seem not to understand the process of continuous assessment. Egbeyemi (2002) noted that all teachers trained at the inception of the programme between 1984 and 1989 have risen to high position and left the assignment of continuous assessment in the hand of relatively junior and inexperienced teachers who have not been formally trained. It is observed that teachers arbitrarily awards marks to students in internal examinations through the assessment procedures. This observation could be supported by the public criticism over the inconsistency in the practice of the system. Evidence shows that much emphases are been laid on the test/examination and assignment as the only means of generating scores. Some teachers have limited knowledge of different forms of assessment, some felt they have no time to create different forms of assessment while some felt there was little or no professional guidance; therefore they are not confident enough to try other forms of assessment. This probably explained why Obanya (1985) described the implementation as caricature. Closely allied to this problem is further faking of continuous assessment scores that examining bodies require particularly for the examination conducted at the end of senior secondary school. Some teachers awarded

scores on test never administered. Not only when the school registrars are to submit their continuous assessment scores, some seem to cook continuous assessment scores from nowhere and submit such scores (Ayodele, 2009).

From the researcher's personal experience as once a registrar, some teachers awarded scores on test never administered while some administered, never marked but generate scores since the policy states that there must be two tests in a term. Nwabuisi (1987) revealed that some teachers awarded fake marks to tests even on test never administered. He went further to state that those practices continue to linger on repeatedly as years progresses. Study on Emeka (1994) showed that attitude toward the practice of continuous assessment was poor, records and scores were not kept properly. Bandele, (1993) pointed out that something was wrong in the internal assessment as practiced in schools in the country. His analysis showed that internal assessment is more prone to abused and is less reliable than external assessment. There is also the problem of over emphasis on the cognitive domain with the neglect of the affective and psychomotor domains of behaviour.

It is also observed that a good number of Mathematics teachers are not experts in the practice of continuous assessment and it requires absolute dedication and committed teachers to assess the domains comprehensively and to make the whole process a success. Most of the teachers do not understand the fundamental principles of the system. Continuous assessment which is supposed to make students work hard and have qualitative education is observed to have made students to tend to be lazy, absent from lessons, involved in examination malpractices and other social vices which are alleged to unreliable continuous assessment in Mathematics.

Ability of the teacher to carry out the practice of continuous assessment in mathematics, that is, to assess the mental, personality traits and the manipulative skills of students through the use of different forms of assessment techniques depend on the teacher's knowledge, skills, competence, experience, educational qualification in the subject area as well as knowledge of continuous assessment. Teacher's factors which are the process variables (teacher's personality, knowledge, experience and qualification) is very critical to improving continuous assessment practice so that the assumption that continuous assessment will elicit the interest of students in studying mathematics will be achieved. The major purpose of this study was to investigate the causal effect of process variables on mathematics continuous assessment practice in senior secondary schools. Similarly, to also investigate how continuous assessment is being carried out in schools especially in mathematics in relation to the award of scores in cognitive, affective and psychomotor domains.

2. Research Hypotheses

The following hypotheses were generated and tested at 0.05 level of significance.

- Ho₁: Path coefficients of process variables and mathematics cognitive continuous assessment practice are not significant.
- Ho₂: Path coefficients of process variables and mathematics affective continuous assessment practice are not significant.
- Ho₃: Path coefficients of process variables and mathematics psychomotor continuous assessment practice are not significant.
- Ho₄: Path coefficients of process variables and mathematics total continuous assessment practice are not significant.

3. Methodology

The study adopted causal-comparative research design to describe the extent to which process variables are prior determinants of the mathematics continuous assessment practice in senior secondary schools. Path analytic model was used to decomposed and interpret the linear relationship among process variables and continuous assessment. A questionnaire with reliability coefficients of 0.84 and construct validity coefficient of 0.65 was used to collect data on process and mathematics continuous assessment. The sample for the study consisted of 300 senior secondary school mathematics teachers. Multi-stage and purposeful random sampling techniques were employed to select Ondo State, Ekiti State and Oyo state. 12 local government areas were selected from the states using purposeful and stratified random sampling. 20 senior secondary schools were selected from each state using stratified sampling and 5 mathematics teachers were selected from each of the schools using stratified sampling technique.

The data collected were analysed using descriptive and inferential statistics. Frequency counts and percentages were used to answer the questions raised. Path analysis was used for the hypotheses. All the hypotheses were tested at 0.05 level of significance.

4. Results

- Question 1: what are the prevalent process variables in the determinant of mathematics continuous assessment practice in schools?

	ITEMS	NO		YES	
		Freq.	%	Freq.	%
	In my school we have:				
1	Qualified mathematics teachers	023	7.7	277	92.3
2	Enough specialist mathematics teachers	118	39.3	182	60.7
3	Professionally trained mathematics teachers	059	19.7	241	80.3
4	Experienced mathematics teachers that will enhance effective teaching as well as assessment	036	12.0	264	88.0
5	Experienced mathematics teachers who can try out other forms of assessment techniques	041	13.7	259	86.3
6	Mathematics teachers with a broad educational background and professional competence	046	15.3	254	84.7

7	Mathematics teachers that varies the teaching- learning process to encourage active participation	041	13.7	259	86.3
8	Knowledgeable mathematics teachers that is able to choose different assessment methods for different purposes	030	10.0	270	90.0
9	Knowledgeable mathematics teachers that brings abstraction into concrete for better understanding	041	13.7	259	86.3
10	Mathematics teachers who can diagnose student's personal need and difficulties	068	22.7	232	77.3
11	Mathematics teachers who can take care of student's personal need and difficulties	072	24.0	226	76.0
12	Mathematics teachers who listen to students, observe them and make sense of what they say or do	033	11.0	267	89.0
13	For the practice of continuous assessment, attention should be shifted from assessing students' achievement to assessing student's learning progress	047	15.7	253	84.3
14	Shift attention from undue emphasis on the covering of syllabus at the expense of meaningful learning of mathematical concept.	070	23.3	230	76.7

Table 1: Frequency counts and percentages showing the prevalent process variables in the determinant of mathematics continuous assessment practice in schools

Table 1 show that the respondents responded positively to all the sixteen items. Each of the items has a percentage rated above 50.

- Question 2: what is the continuous assessment practice based on in secondary schools?

	Items: In my school assessment is based on;	No		Yes	
		Freq	%	Freq	%
1	Periodic tests only	282	94.0	018	6.0
	Periodic test plus:				
2	rating of students' performance	15	5.0	285	95.0
3	students' assignment scores	69	23.0	231	77.0
4	rating of students' interest	255	85.0	045	15.0
5	rating of students' attitude to Mathematics	249	83.0	051	17.0
6	quality of students' Mathematics notes	198	66.0	102	34.0
7	students attendance at Mathematics lesson	156	52.7	142	47.3
8	students' positive interaction during Mathematics lesson	236	78.7	064	21.3
9	students' project scores	240	80.0	060	20.0
10	students' Mathematical skills	226	75.3	074	24.7
11	Student's hand writing	253	84.3	047	15.7
12	Creativity in drawing	251	84.7	049	16.3
13	Handling of mathematical tools	260	86.7	040	13.3
14	Scores awarded by the school	236	78.3	065	21.7
15	Scores awarded by the teacher	104	34.7	196	65.3
16	Scores vetted by the school	239	79.7	061	20.3

Table 2: Frequency counts and percentages showing the extent of Continuous assessment practice in schools.

Table 2 shows that continuous assessment in schools was based on periodic tests plus rating of students' performance, students' assignment scores and scores awarded by the teachers (with the cut off fixed at 50% and above).

5. Hypotheses

- Hypothesis 1: path coefficients of process variables and mathematics cognitive continuous assessment are significant. The path model in figure 1 was employed in testing this hypothesis

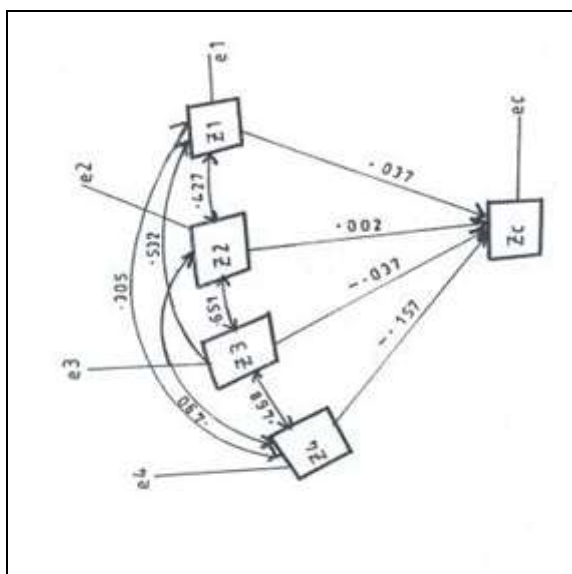


Figure 1: Hypothesized path model among Process Variables and Cognitive Continuous Assessment
Source: Authors' Design, 2014

Paths	Path Coefficients	Decision
$P_{c1}Z_1$.037	Deleted
$P_{c2}Z_2$	-.002	Deleted
$P_{c3}Z_3$	-.037	Deleted
$P_{c4}Z_4$	-.157*	Retained

Table 3: path coefficients of process variables and mathematics cognitive continuous assessment practice.
Note: * = Significant at $p > .05$

Table 3 shows the path coefficients of teacher’s personality and cognitive assessment practice of (0.037), teacher’s knowledge of (-0.002) and teacher’s experience of (-.0.037) and teacher’s qualification of (-.157). This shows that only teacher’s qualification path coefficient had significant causal effects and therefore was retained. This shows that path coefficients of process variables and mathematics cognitive continuous assessment are significant. The model above represents the paths.

- Hypothesis 2: Path coefficients of process variables and mathematics affective continuous assessment practices are not significant.

The path model in figure 2 was employed in testing this hypothesis

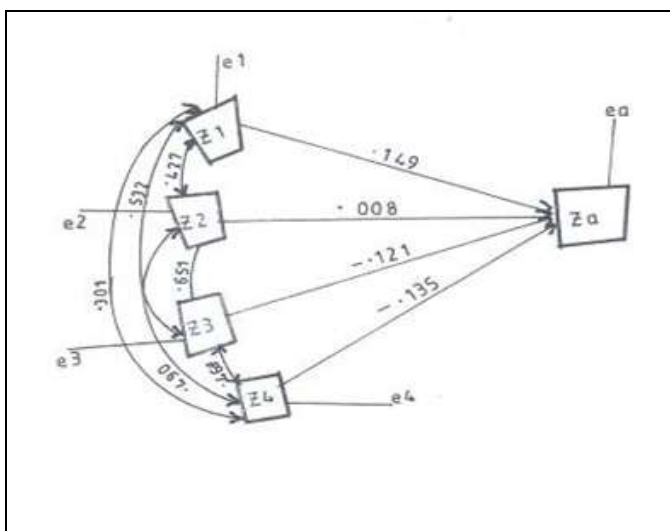


Figure 2: Hypothesized path model among Process Variables and Affective Continuous Assessment
Source: Authors' Design, 2014

5.1. Continuous Assessment

Paths	Path Coefficients	Decision
$P_{a1}Z_1$.149*	Retained
$P_{a2}Z_2$.008	Deleted
$P_{a3}Z_3$	-.121*	Retained
$P_{a4}Z_4$	-.135*	Retained

Table 4: path coefficients of process variables and affective continuous assessment practice.

Note: * = Significant at $p > .05$

Table 4 shows the paths among process variables and affective continuous assessment. It shows path coefficients of teacher’s personality of (.149), teacher’s knowledge of (.008), teacher’s experience of (-.121) and teacher’s qualification of (-.135) on affective continuous assessment practice. It could be seen from the table that 3 paths had significant causal effects and therefore were retained while a path that had insignificant causal effect were deleted. Hence, it can be concluded that path coefficient of the process variables and mathematics affective continuous assessment are significant. The model above represents the paths.

- Hypothesis 3: path coefficients of process variables and mathematics psychomotor continuous assessment practice are not significant.

The path model in figure 3 was employed in testing this hypothesis

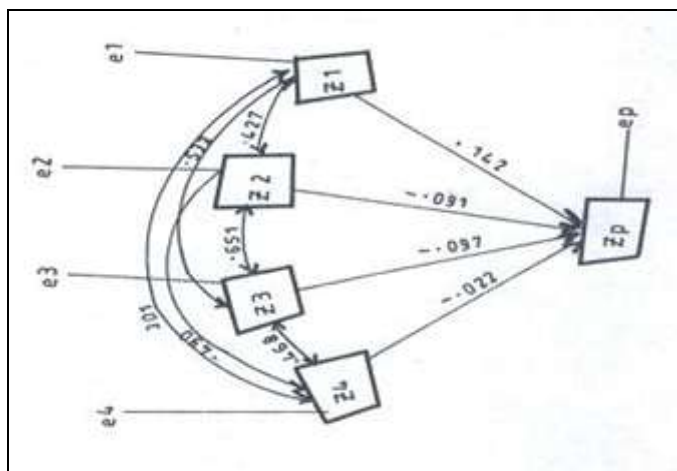


Figure 3: Hypothesized path model among Process Variables and Psychomotor Continuous Assessment

Source: Authors’ Design,2014

Path	Path Coefficients	Decision
$P_{p1}Z_1$.142*	Retained
$P_{p2}Z_2$	-.091*	Retained
$P_{p3}Z_3$	-.097*	Retained
$P_{p4}Z_4$	-.022	Deleted

Table 5: path coefficients of process variables and psychomotor continuous assessment practice.

Note: * = Significant at $p > .05$

Table 5 shows the paths among process variables and psychomotor continuous assessment practice. Teacher’s personality had a path coefficient of (.142), teacher’s knowledge of (-.091), teacher’s experience of (-.097) and teacher’s qualification of (-.022). It could be seen from the table that teacher’s personality, knowledge and experience had significant causal effects on psychomotor domain while teacher’s qualification had insignificant causal effect and were therefore deleted. This shows that path coefficients among process and psychomotor continuous assessment practice are significant. The model above represents the paths.

- Hypothesis 4: Path coefficients of process variables and mathematics total continuous assessment practice are not significant.

The path model in figure 4 was employed in testing this hypothesis

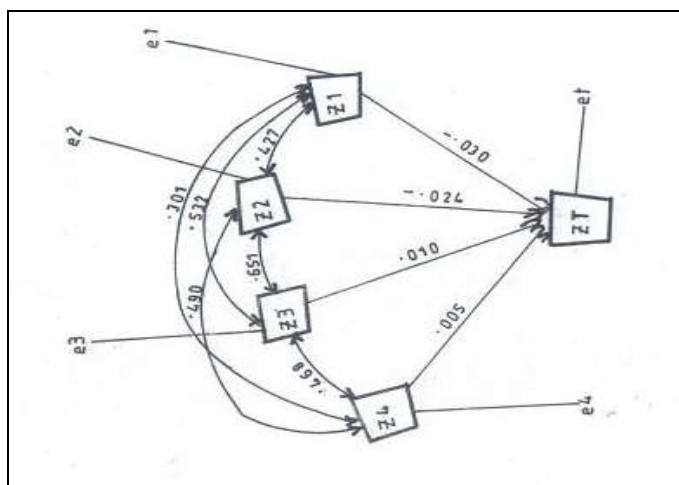


Figure 4: Hypothesized path model among Process Variables and Total
Source: Authors' Design, 2014

5.2. Continuous Assessment

Paths	Path Coefficients	Decision
P _{T1} Z ₁	-.030	Deleted
P _{T2} Z ₂	-.024	Deleted
P _{T3} Z ₃	.010	Deleted
P _{T4} Z ₄	.005	Deleted

Table 6: path coefficients of process variables and total continuous assessment practice.
Note: * = Significant at $p > .05$

Table 6 shows the paths among process variables and mathematics continuous assessment practice with teacher's personality path coefficient of (-.030), teacher's knowledge of (-.024), teacher's experience of (.010) and teacher's qualification of (.005). This implies that none of the path coefficients had significant causal effects on comprehensive continuous assessment in mathematics. Hence, the hypothesis is not rejected. The model above represents the paths.

The hypothesized path model below was used to summarise the paths among process variables and mathematics continuous assessment practice.

The path model in figure 5 was employed in summarizing the four hypotheses

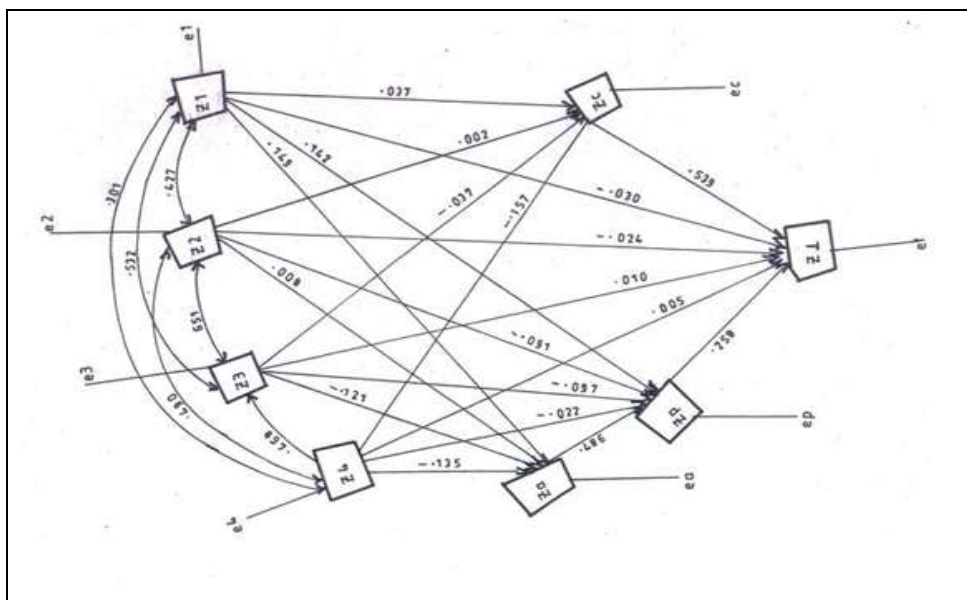


Figure 5: Summary of hypothesized path model among Process Variables, cognitive, affective psychomotor and total Continuous Assessment practice in schools.
Source: Authors' Design, 2014

6. Discussion

The findings showed that there are experienced, qualified, knowledgeable mathematics teachers with high personality traits for the teaching and learning of mathematics but in continuous assessment practice emphases are only based on the assessment of cognitive domain leaving affective and psychomotor domain not assessed.

Behind any successful lesson in mathematics is a good teacher, it takes a good teacher to apply the correct method in his presentation to arouse the interest of his learner before assessment. The result support Adekolajo (1993) who confirmed a teacher to be a leader who will be both academically and professionally qualified with good cultural background. The result also agreed with MoEST and MIE (2003) who confirmed an effective mathematics teacher as a knowledgeable facilitator of the teaching and learning, who guides learner to achieve their potential, as a skill trainer, a role model to learners and as an active classroom researcher

Evidence from the study revealed that continuous assessment is based mainly on the assessment of cognitive domain. In order to assess each learner adequately, to discover their latent skills, knowledge and abilities in mathematics; teachers would resort to test at various times and at various locations which aimed at collecting information with respect to the cognitive, affective and psychomotor domains.

The result supports Idowu and Esere (2009) that most of the teachers are familiar with assessment in the cognitive domain alone. Comprehensiveness in continuous assessment is not just about intellectual ability. It is about acquisition of interpersonal skills, about right character, traits, about discipline, about aptitude and skills. All these are to be factored in the overall performance of students and used for guidance and career purposes.

It could be seen from the study that continuous assessment being practiced in schools are not comprehensive. It simply means that what is being practiced is continuous testing instead of continuous assessment. For successful implementation of the continuous assessment approach, teachers need to give more tests, which mean more marking. They need to observe the learner more keenly to assess their affective outcomes, and there will be more records to be kept on the learners. All these could mean more work to the teacher, more demand on his /her time and more responsibility on him or her. This mean they must be professionally and attitudinal prepared, experienced and adequate knowledge. Similarly, availability of facilities and supportive environment can motivate and generate interest in students to study mathematics and contribute to the efficiency of proved competent teachers. Egbeyemi (2002) noted that all teachers trained at the inception of the programme have risen to high position and left the assignment of continuous assessment in the hand of relatively inexperienced teachers who have not been formally trained.

From the result of hypothesis one on the cognitive assessment, teacher's qualification had negative causal effect while other paths were deleted. The deleted paths show that the adequate skills and experience to be possessed by mathematics teachers to be able to carry out cognitive assessment were not demonstrated. Osunde (2008) opines that most of the teachers lack adequate skills to develop and validate teachers made test for use in school based assessment.

Hypothesis two on the assessment of affective domain, teacher's personality had significant positive causal effect. Mathematics teachers are looked upon as recourse linkers when they link learners with all resources both human and non human. As important as mathematics is, for most students the subject is not a source of satisfaction but rather one of the frustration, boring abstract etc. ability of the teacher to use his/ her personality trait will enable him/ her to assess the students' abstract phenomenon in mathematics so as to elicit the interest of students in studying mathematics and also improve in their performance. Similarly teacher's experience and qualification had negative causal effects. This shows that though the teachers are qualified and experienced in the teaching of mathematics yet inexperience in the assessment of affective domain.

Similarly teacher's personality had positive and high significant causal effects on the assessment of psychomotor domain while teacher's knowledge and experience had negative causal effects. The negative causal effects might be as a result of inability of the teacher to factor the assessment of affective and psychomotor domains to the overall performance of the students.

Lastly on the assessment of total continuous assessment, none of the process variables had significant causal effects on comprehensive continuous assessment but all had indirect causal effect through cognitive, affective and psychomotor domains. This is an indication that the continuous assessment practice in the school system is not total.

7. Conclusion

Based on the findings of this study, it is therefore concluded that the practice of continuous assessment in the school system is cognitive assessment oriented. This implies that continuous assessment is based on the mental abilities of the students leaving interest, attitude and mathematics manipulative skills not assessed. The

8. Recommendation

1. Training should be organised for the teachers on comprehensive assessment of continuous assessment (cognitive, affective and psychomotor domains) with the use of various assessment techniques
2. Seminar and workshop should be organised for the teachers where they would be taught how to factor affective and psychomotor domains into the overall assessment of the students.
3. Adequate materials and facilities necessary for acquisition of skills on the psychomotor domain should be provided in schools
4. Affective education should be provided in schools to correct the anti-social behaviour of the students and also observe the learners more keenly to assess their affective outcomes

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