Student Progress Monitoring for Continuous Value-Added Mathematics Achievements

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ABSTRACT

Student progress monitoring helps a teacher to define a student's current performance level on skills to be learned in a year, identifies his year-end achievement goals, and establishes the progress rate at which he must work to achieve the goal. A teacher is also able to create and strategize effective teaching approaches to cater for a student's level of readiness and learning needs and fulfil appropriate stretch goals for further learning. While there are many existing assessment tools for teachers and the school system to use at monitoring a student's proficiency in Mathematics, this article has chosen to share findings related to the application of the easy and simple to use Expected Target Result (ETR) approach in one of the districts in Malaysia. Using average school grades in the Year Five examination as Take-Off Value, the approach was able to provide information on the progress of all students and all schools according to subject and type of school. Based on the benchmarks generated for each subject by this approach, teachers were able to define effective teaching methods to cater for continuous progress in students' work.

Keywords: *Expected Target Result, progress monitoring, Take-Off Value*

INTRODUCTION

A teacher needs to monitor the progress or growth of a student's learning process for successful learning to occur (Masters, 2016). During the process, he defines the student's current performance level on skills to be learned in that year, identifies achievement goals to be reached by year end and establishes the student's progress rate in meeting those goals. A teacher can use gathered information to design effective teaching approaches to target a student's level of readiness and learning needs. He can also set appropriate stretch goals for further learning. Progress monitoring is an effective self-regulation strategy. A student takes charge of his own learning by monitoring his own progress and makes desired adjustments to satisfy learning goals. Incidence of progress monitoring increases with increased interventions. Therefore, progress monitoring also promotes behaviour change in students (January et al., 2018; Van Norman, Nelson, & Parker, 2017).

A school expects all students to excel in their learning regardless of their take-off point, thus schools use data to monitor students' progress. As a result, students learn more, teacher decision making improves, and students become more aware of their own performance (Cauley & McMillan, 2010; Suskie, 2018). Every now and then, reports are submitted to education leaders i) to describe if the standards have declined or improved in schools and school system; ii) to address students' performance according to groups, places of study, and teaching strategies; and iii) to evaluate the impact of school-wide and system-wide programs (Fuchs & Fuchs, 1992; Masters, 2016; Safer & Fleischman, 2005).

Many well-paying jobs require mathematical proficiency. A high school student's mathematics achievement defines his future success at tertiary education and future growth of his career earnings. A

student who starts ahead in mathematics stays ahead while a student who starts behind stays behind. If researchers can identify critical areas in mathematics that predict later mathematics proficiency, education leaders or policy-makers can alleviate efforts to improve teaching and learning in these specific areas (Siegler et al., 2012). This article shares how Expected Target Result (*ETR*) approach helps education leaders to system monitor future mathematics proficiency in Malaysian schools.

PURPOSE OF ASSESSING LEARNING OUTCOMES

Accreditors, employers and policy-makers show great interest in the assessment of learning outcomes. Teachers use appropriate assessment tools to determine the level at which students understand concepts or skills taught in class and how well students apply concepts, knowledge and skills. They are also used to identify students who are at risk academically. More importantly, assessment results help teachers to enhance and vary teaching and learning methods. Therefore, performance data can measure the effectiveness of teaching approaches (Safer & Fleischman, 2005).

Summative assessment is often carried out at the end of a course or a program. Therefore, current students do not receive feedbacks on their performance other than their grades. Teachers are also not able to carry out interventions to improve students' learning. Nevertheless, the results can be used to make changes that affect subsequent students (Lee Abdullah et al.; Suskie, 2018).

TOOLS FOR PROGRESS MONITORING

Some examples of progress monitoring tools are curriculum-based measurement (CBM), Computer-adaptive Assessment (CAT), and Mastery measurement (MM). CBM scoring process is based on classical test theory. CAT uses algorithms and item response theory to estimate student's ability in a previous item before exposing him to higher or lower level items. Both methods disburse final scores after analyzing the assessment items (Van Norman et al., 2017). MM evaluates student performance by running tests with increasing item difficulties to students over a defined time interval. However, it lacks reference to larger generalized skills, thus MM assessments may not be suitable to be used on high-stakes tests. Unlike these three methods, classroom assessment allows teachers to develop more customized, complex assessments of student proficiency. However, they take a long time to administer and to develop such tests (Hanover Research, 2013).

The headcount program is applied to every student in his secondary academic year in Malaysia. It predicts a student's future academic achievement by comparing his current performance to his actual test scores (Ali Abdelwahab, 2010). Procedures of this program are Take-Off Value (*TOV*), *ETR* and Operational Targeted Increment (*OTI*). *TOV* defines the value of a student's work based on his current achievement (normally his year-end result). Using this *TOV*, the teacher evaluates a student's capability by identifying his *ETR* and *OTI*. *OTI* displays whether the improvement trend has increased or decreased in the learning outcomes of a student based on several evaluations made before achieving the *ETR* (Abdullah et al.; Ali Abdelwahab, 2010; Mohamed, Rosly, & Tarmizi, 2018; Suhaimi et al., 2013). The *ETR* approach can be used by education leaders to monitor a school system, as will be discussed in the following section.

THE *ETR* APPROACH

This section presents the *ETR* method as used by the Kluang District Education Office (KDEO). Data from three types of schools: Sekolah Kebangsaan (SK), Sekolah Jenis Kebangsaan Tamil (SJK(T)) and Sekolah Jenis Kebangsaan Cina (SJK(C)) were used to estimate the *ETR* of students in the Unit Penilaian Sekolah

Rendah (UPSR), the national examination for primary schools in Malaysia. Variables included average school grades (*GPS*) of all Year Five students from these schools in 2017. *GPS* was treated as *TOV* which was used to set the *ETR*. The next section of this article will only share findings related to Mathematics. All experimental calculations were done in Excel.

There are several types of *ETR* and each type has its own formula. Examples of *ETR* are *ETR* for average grades of subject, *ETR* for grade A ($ETR_{grade\ A}$), *ETR* for average school grades (ETR_{GPS}) and others. KDEO calculated ETR_{GPS} for every subject in all the schools based on. This calculated value will be the predicted target results based on the average grades of a school. The formula for calculating ETR_{GPS} in this study is given as:

$$ETR_{GPS} = TOV \times (1 - degree\ of\ increement) \quad (1)$$

where TOV was *GPS* based on 2017 Year Five examination and the degree of increment was a value set by the Education office.

If a school achieved an ETR_{GPS} with a bigger value than the one set by the Education office in their first assessment, then the calculation for ETR_{GPS} abides by the following formula:

$$ETR_{GPS} = TOV \times (1 + \text{degree of increment}) \quad (2)$$

and the $\text{degree of increment} = 0.04$ was set by KDEO.

INTERVENTION EFFORTS

Students gave positive ratings to Malaysian mathematics classrooms. Factors with high ratings were step-by-step procedures for solving mathematical problems, enjoyable and interesting learning environment, understandable and meaningful mathematics, and a friendly atmosphere (Tarmizi, Tarmizi, & Mokhtar, 2010). Therefore, progress monitoring should be able to be carried out smoothly.

When students fail to achieve specified learning outcomes, they will participate in appropriate intervention activities (Suhaimi et al., 2013). A screening process is carried out to select students for the intervention activities (Kelanang & Zakaria, 2012). Primary intervention is carried out in normal teaching and learning process in the classroom. Students who perform far below their peers will attend secondary intervention. Here, students will meet in smaller groups for a one and a half-hour session three times a week for eight weeks. Performance of the secondary intervention is monitored weekly. Students who exhibits better achievements will return to primary intervention while those who underperform will join the tertiary intervention. Progress monitoring is carried out in all three interventions. More importantly, students can view their own patterns of changes that take place over these intervals. Some intervention are conducted as mathematics camp with activities like problem solving, reasoning, recreational, social activities, games and stations (Siew-Eng, Kim-Leong, & Siew-Ching, 2010).

RESULTS AND DISCUSSION

Figure 1 displays the *TOV* for all SK schools.

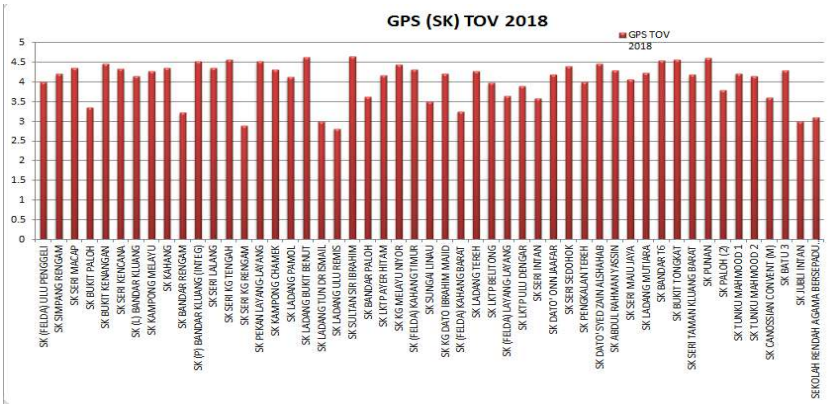

Figure 1: TOV for SK in 2018

Smallest *TOV* value defines best school performance. From Figure 1, SK Ladang Ulu Remis achieved best performance among 51 SKs in the past Year Five examination. Similar figures were drawn up for SJK(C)s and SJK(T)s. From 21 SJK(C)s, the best school performance was awarded to SJK(C) South Malaya while the lowest performing school went to SJK(C) Yu Ming. More effort and attention should be given to SJK(C) Yu Ming to enable the school to produce better achievements in Mathematics. From among 17 SJK(T)s, the best school performance went to SJK(T) Ladang Nyior while the school that needed most attention was SJK(T) Ladang Southern Malay.

ETR tables were drawn to show *TOV* and *ETR* for 2018. *TOV* defines the level of mathematics proficiency displayed by the students. *TOV* for SK, SJK(C) and SJK(T) were 4.16 (see Table 1), 3.09 and 3.71, respectively. The smallest value obtained indicates highest level of competence in the said subject. Therefore, most of the students from SJK(T)s have gained high proficiency levels in Year Five Mathematics.

Table 1: TOV and ETR for SKs

NO.	SCHOOL'S NAME	*TOV* 2018	*ETR* 2018
1	SK (FELDA) ULU PENGGELI	4	3.84
2	SK SIMPANG RENGAM	4.2	4.03
3	SK SERI MACAP	4.36	4.19
4	SK BUKIT PALOH	3.35	3.22
5	SK BUKIT KENANGAN	4.47	4.29
6	SK SERI KENCANA	4.33	4.16
7	SK (L) BANDAR KLUANG	4.15	3.98
8	SK KAMPONG MELAYU	4.28	4.11
9	SK KAHANG	4.35	4.18
10	SK BANDAR RENGAM	3.22	3.09
11	SK (P) BANDAR KLUANG (INTEG)	4.52	4.34
12	SK SERI LALANG	4.35	4.18
13	SK SERI KG TENGAH	4.57	4.39
14	SK SERI KG RENGAM	2.88	2.76
15	SK PEKAN LAYANG-LAYANG	4.52	4.34
16	SK KAMPONG CHAMEK	4.31	4.14
17	SK LADANG PAMOL	4.13	3.96
18	SK LADANG BUKIT BENUT	4.62	4.44
19	SK LADANG TUN DR ISMAIL	3	2.88
20	SK LADANG ULU REMIS	2.81	2.70
21	SK SULTAN SIR IBRAHIM	4.65	4.46
22	SK BANDAR PALOH	3.63	3.48
23	SK LKTP AYER HITAM	4.17	4.00
24	SK KG MELAYU NIYOR	4.44	4.26
25	SK (FELDA) KAHANG TIMUR	4.32	4.15
26	SK SUNGAI LINAU	3.5	3.36
27	SK KG DATO IBRAHIM MAJID	4.22	4.05
28	SK (FELDA) KAHANG BARAT	3.25	3.12

29	SK LADANG TEREH	4.27	4.10
30	SK LKTP BELITONG	3.97	3.81
31	SK (FELDA) LAYANG-LAYANG	3.64	3.49
32	SK LKTP ULU DENGAR	3.89	3.73
33	SK SERI INTAN	3.59	3.45
34	SK DATO' ONN JAAFAR	4.19	4.02
35	SK SERI SEDOHOK	4.4	4.22
36	SK PENGKALAN TEREH	4	3.84
37	SK DATO' SYED ZAIN ALSHAHAB	4.47	4.29
38	SK ABDUL RAHMAN YASSIN	4.3	4.13
39	SK SERI MAJU JAYA	4.07	3.91
40	SK LADANG MUTIARA	4.24	4.07
41	SK BANDAR T6	4.54	4.36
42	SK BUKIT TONGKAT	4.57	4.39
43	SK SERI TAMAN KLUANG BARAT	4.18	4.01
44	SK PUNAN	4.6	4.42
45	SK PALOH (2)	3.8	3.65
46	SK TUNKU MAHMOOD 1	4.21	4.04
47	SK TUNKU MAHMOOD 2	4.15	3.98
48	SK CANOSSIAN CONVENT (M)	3.61	3.47
49	SK BATU 3	4.29	4.12
50	SK JUBLI INTAN	3	2.88
51	SEKOLAH RENDAH AGAMA BERSEPADU KLUANG	3.1	2.98
TOTAL		4.16	3.99

Further observations on mathematics competency can be made by comparing the *TOV*s obtained by all the schools. Based on the *TOV*s for each school, teachers can strategize teaching approaches to suit their objective at improving the achievement of the students. More importantly, every school has been assigned a calculated *ETR* value based on their students' *TOV*. This value should be the benchmark to be achieved in the UPSR for 2018.

EFFECTIVENESS OF THE *ETR* APPROACH

Three characteristics define an effective progress monitoring namely i) measure student performance, ii) quantify level of improvement and responsiveness of students to instruction, and iii) evaluate instruction methods for effectiveness. Many tools were practical to be used for progress monitoring such as CBM, MM and CAT. However, many practitioners have debated which or if there is a best progress monitoring model. Thus far, the National Center on Response to Intervention has not named a single best method. However, it has listed a few items that can be considered in progress monitoring: i) monitoring tools fit age and skill levels of students who are assessed, ii) schedule for administration of tests must be pre-set, iii) regular review meetings, iv) determine sample size and time for progress evaluation, and v) transparent decision-making practices (Hanover Research, 2013).

In this study, students' achievements in Year Five examination defined teacher intervention efforts over a period of one year. Analysis of UPSR results a year later confirmed the success of intervention efforts. In addition to fitting all three characteristics of an effective progress monitoring tool, only a short time is required to generate results using the *ETR* approach.

CONCLUSION

Effective teaching by a teacher or effective learning by a student need to be assessed from time to time. The *ETR* approach used by KDEO is a simple and easy approach to determine continuous status of schools in the district with regards to teaching and learning of many subjects. The *ETR*

approach not only provides benchmarks for the school to achieve, it also helps the teaching units within the school to monitor achievements by the students according to subject. More importantly, the ETR approach has fitted all three characteristics of an effective progress monitoring tool.

Students come with different background knowledge. It is vital to check for understanding of students in a teaching and learning environment. There are also many types of formative assessments that can be used. Checking for understanding occurs in three steps: i) feed-up (establishing a purpose, objective and learning target), ii) feedback (responding to student work) and feed-forward (modifying instruction)(Cauley & McMillan, 2010). Regardless of type of assessment used, steps ii) and iii) can be better carried out if an effective progress monitoring tool such as the *ETR* approach is used. Therefore, future mathematics proficiency can be easily defined for all students.

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REFERENCES

Abdullah, M. F. N. L., Hamzah, M. S. G., Ahmad, C. N. C., Adnan, M., Noh, N. M., Suhaimi, S., & Janoory, L. An instrument to assess secondary school mathematics teacher's assessment practices in Malaysia.

Ali Abdelwahab, N. (2010). *A heuristic approach to predict Malaysian students academic performance.* University of Malaya.

Cauley, K. M., & McMillan, J. H. (2010). Formative assessment techniques to support student motivation and achievement. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83*(1), 1-6.

Fuchs, L. S., & Fuchs, D. (1992). Identifying a measure for monitoring student reading progress. *School Psychology Review, 21*(1), 45-58.

Hanover Research. (2013). Review of K-12 Literacy and Math Progress Monitoring Tools.

January, S.-A. A., Van Norman, E. R., Christ, T. J., Ardoin, S. P., Eckert, T. L., & White, M. J. (2018). Progress Monitoring in Reading: Comparison of Weekly, Bimonthly, and Monthly Assessments for Students at Risk for Reading Difficulties in Grades 2–4. *School Psychology Review, 47*(1), 83-94.

Kelanang, J. G. P., & Zakaria, E. (2012). Mathematics difficulties among primary school students. *Advances in Natural and Applied Sciences, 6*(7), 1086-1092.

Lee Abdullah, M. F. N., Hamzah, M. S. G., Che Ahmad, C. N., Adnan, M., Mohamed Noh, N., Suhaimi, S., & Janoory, L. An instrument to assess secondary school mathematics teacher's assessment practices in Malaysia.

Masters, G. N. (2016). Mapping progress: using data for teaching and learning. *International Developments, 6*(6), 3.

Mohamed, T. N. L. B. T., Rosly, R. B., & Tarmizi, M. L. B. M. (2018). Evaluating English Module: Guidance to Help Develop Ideas for Writing. *European Journal of Education, 1*(2), 64-68.

Safer, N., & Fleischman, S. (2005). Research matters: How student progress monitoring improves instruction. *Educational Leadership, 62*(5), 81-83.

Siegler, R. S., Duncan, G. J., Davis-Kean, P. E., Duckworth, K., Claessens, A., Engel, M., . . . Chen, M. (2012). Early predictors of high school mathematics achievement. *Psychological science, 23*(7), 691-697.

Siew-Eng, L., Kim-Leong, L., & Siew-Ching, L. (2010). Mathematics Camp Model for Primary School. *Procedia-Social and Behavioral Sciences, 8*, 248-255.

Suhaimi, S., Nizam, M., Abdullah, L., Hamzah, M., Ahmad, C., Adnan, M., & Noh, N. (2013). An Instrument to Assess Secondary School Mathematics Teacher Assessment Practice. *International Higher Education Teaching and Learning. Malaysia*.

Suskie, L. (2018). *Assessing student learning: A common sense guide*: John Wiley & Sons.

Tarmizi, M. A. A., Tarmizi, R. A., & Mokhtar, M. Z. B. (2010). Humanizing mathematics learning: Secondary students beliefs on mathematics teachers' teaching efficacy. *Procedia-Social and Behavioral Sciences, 8*, 532-536.

Van Norman, E. R., Nelson, P. M., & Parker, D. C. (2017). Technical adequacy of growth estimates from a computer adaptive test: Implications for progress monitoring. *School Psychology Quarterly, 32*(3), 379.