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# Perception toward formative assessment literacy and practice among secondary school mathematics teachers

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**ABSTRACT**

This study investigated the perceived formative assessment literacy and practice among mathematics teachers at secondary schools to examine the impact of literacy on assessment practices. The cluster random sampling technique was employed to select sample districts, schools, and participants. A total of 64 mathematics teachers took part in the study. The measuring scales applied for data collection were the "Teacher formative assessment literacy scale and teacher formative assessment practice scale". The data analysis was performed with SPSS 27 software to compute mean scores, standard deviations, intervals, and regression coefficients. The result showed that teachers' literacy and practice of formative assessment are at a moderate level, but the classroom practice is more teacher-directed. Regression analysis revealed that assessment literacy significantly predicted assessment practice ($\beta$=0.67, $p$<0.001), implying assessment literacy showed a moderately positive impact on assessment practice ($R^2$=0.359, $F$(1, 62)=34.962, $p$<0.001), The study concluded the need to improve teacher formative assessment literacy and practice levels to enhance their ability to utilize formative assessment in student teaching and learning strategies properly. The study's implications and recommendations indicate the arrangement of intervention and on-the-job professional development training for teachers.

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## 1. INTRODUCTION

The importance of formative assessment in the educational arena, particularly in classroom assessment, is a highly recognized phenomenon since its introduction into educational programs as a "formative evaluation" by Michael Scriven in the late 1960s [1]. Formative assessment gradually reached momentum in the late 1990s following the seminal work of Black and Wiliam published in [2], [3]. Meanwhile, the concept of teacher assessment literacy (TAL), which Stiggins coined in the early 1990s, for the sake of improving teachers' competency in student assessment, got considerable attention in the United States of America [4]. This initiated the development of the seven assessment standards by the joint work of the American Federation of Teachers (AFT), National Council on Measurement in Education (NCME), National Education Association (NEA) for measuring teacher's competence in educational assessment of students in seven competency areas [5]; followed by the development of a standardized instrument with 35 items to assess the standards [6] which is still in use by researchers across many countries.

A group of researchers, however, argued that the existing assessment literacy instruments do not fully reflect current transformations in the assessment landscape and remain grounded on dated standards for classroom assessment practice [7]; yet the majority of teachers assessment literacy measures continue to be

based on early conceptions of teacher assessment literacy [8]. Later on, a three-dimensional model of teacher formative assessment literacy was proposed [9], as it roots itself in the social-constructivist learning theory [10]. Based on this model, Yan and Pastore [11] developed an instrument measuring teacher formative assessment literacy. Consequently, the aforementioned researchers developed the two-dimensional instrument measuring teacher formative assessment practice [12] on the basis of the five formative assessment strategies previously proposed by Wiliam *et al*. [13]. The instruments are the teacher formative assessment literacy scale (TFALS) and teacher formative assessment practice scale (TFAPS). The TFALS has three subscales, namely, conceptual dimension (CD), practical dimension (PD), and socio-emotional dimension (SED). The TFAPS has two subscales, they are the teacher-directed formative assessment (TdFA) and the student-directed formative assessment (SdFA). Thus, the researchers of the current study directly adapted both instruments in this survey study. Thus, the purpose of this study is to describe mathematics teachers perceived formative assessment literacy, formative assessment practice, and the impact of their literacy on formative classroom assessment practice based on the social-constructivist learning paradigm.

Formative assessment is rooted in the constructivist worldview [14]. According to Sardareh and Saad [15], social constructivists view formative assessment as an interactive process in which peers and teachers help students use their zone of proximal development (ZPD) to advance to the next learning level. It emphasizes the collaborative learning processes that need teachers to establish a student-centered learning environment that encourages active participation and critical thinking for effective exploration and retention of the learned information [16]. In the constructivist paradigm, a key component of the social processes is mediating the growth of students' intellectual capacities, the creation of knowledge, and the formation of their identities would be the close evaluation of their understandings by teachers, peer feedback, and students themselves [17]. In constructivist theory, assessment should provide continuous feedback to learners about their progress and enhancement options. Formative assessment is viewed as a part of the learning process in which students play a greater role in judging their own and each other's progress through self-assessment and peer assessment [14]. Due to such paradigm change brought about by the constructivist approach from assessment of learning to assessment for learning, formative assessment is believed to have a significant advantage in the teaching-learning process by helping teachers adjust their instruction and students to improve their learning thereby enhancing their achievement standards [3], [18], [19]. In this regard, İzcİ *et al*. [20] noted that the desired effect of formative assessment depends on teachers' comprehensive understanding and proper application of formative assessment strategies in classroom assessment practices. However, Black and Wiliam [3] noted that despite its substantial impact, formative assessment practice remains insignificant due to teachers' lack of knowledge and understanding. Hence, it is important to review some of the recent empirical studies to see the current status of secondary school teachers' formative assessment literacy and practices in some countries.

Empirical studies on secondary school teachers' assessment literacy and practices across countries report inconsistent results. To start with the TFALS, the authors of the instrument reported that the observed mean score of the TFALS ranges from 4.64-4.96 in Chinese secondary school cases [11]. Another author who adapted the TFALLS into Turkey's language [20] reported that the mean for the CD, M=4.96, PD, M=5.02, and SED, M=5.11. Regarding teachers' formative assessment practice, the authors of the instrument found out that respondent's rate higher in the TdFA and lower in the SdFA subscale, indicating that teachers usually focus on the TdFA rather than the SdFA [12]. Besides, research that studied teachers' practices of FA strategies in Pakistan reported an overall mean M=4.78 (SD=0.56), showing that teachers slightly agreed [21]. Concerning the impact of assessment literacy (AL) on practice, a study from Iran revealed that teachers' assessment literacy has a significant impact on classroom assessment efficiency [22]. Similarly, two studies from Iran and Indonesia reported that teachers' assessment literacy has a statistically significant impact on learners' writing achievements, and teachers' assessment awareness leads teaching environments to effective and motivated assessment design [23], [24]. In the meantime, Brown *et al*. [10] noted that teachers' assessment practices are consistently related to their knowledge, skills, and beliefs or their assessment literacy. In regard to TAL level, Luitel [25] reported a high literacy status of the Nepali teachers. Other studies from Malaysia and Pakistan reported teachers had an average/moderate level of AL [21], [26], [27]. Yet another study reported that the general level of Indonesian EFL or English as a Foreign Language teachers' assessment literacy is fair [28]. Lastly, Akayuure [29] reported that the majority of Ghanaian mathematics teachers did not attain the required assessment literacy standards for quality classroom assessment practices.

On the other hand, some other studies reported contrasting results. For example, a study from Ethiopia reported that teachers have good assessment conceptions but fail to practice; they use summative assessment that is teacher-dominated [30]. Similarly, one study from Ghana reported that teachers had a correct conception of formative assessment, but their practices were not formative assessment [31]. Another study from Greece revealed that teachers use some formative assessment principles, but their approaches are

more teacher-directed [32]. Study reports from Pakistan and Tanzania showed teachers have good knowledge of constructive feedback but do not utilize it [33], [34]. Yet, a study from Nigeria reported that teachers' knowledge of formative assessment practices is poor [35]. A study from New Delhi revealed that teachers' understanding of sociocultural perspectives on assessment for learning (AfL) is minimal [36]. Regarding the formative assessment practices, interestingly, two study reports from Indonesia and Nepal reported that teachers practice formative assessment strategies at most [37], [38]. Two studies from Ethiopia reported that teachers' classroom assessment practices are at a moderate or medium level, mostly inclined to traditional assessment methods [39, [40]. Still, some other studies from Ghana and Malaysia reported that teachers mostly employ conventional assessment methods [41] and commonly use teacher-centered strategies [42]. A study report from Turkey indicated that many classroom activities were teacher-centered, did not apply self/peer assessment, and feedback based on measurement scores [43]. In general, most of these research reports on secondary school teachers show that the conditions of teachers' formative assessment literacy and practice need significant attention to improve the present state of teachers' literacy and formative assessment practice.

Despite the tremendous advantages of formative assessment, the result from this review provides highlights about the current status of teachers' formative assessment literacy and classroom assessment practices at schools. There are many gaps to be thoroughly investigated about formative assessment literacy and practice. Therefore, this study was designed to describe the existing status of teachers' formative assessment literacy and practices using the recently developed theory-driven instruments. Almost all of the reviewed articles used different instruments, either adopted from other sources or self-developed instruments, in both literacy and practice cases. The researchers of this paper directly adapted these instruments with the full consent of the respective authors. The reasons for adapting these instruments are manifold. First, the non-availability of appropriate instruments and their relevance to the topic under study. Secondly, they are user-friendly and easily manageable for researchers and respondents. Thirdly, they are highly informative of teachers' formative assessment literacy and classroom formative assessment practice for classroom teachers, school authorities, researchers, policy-makers, and curriculum developers. Thus, the guiding research questions of the study are the following: i) what is the perceived status of Jimma Zone secondary school mathematics teachers' formative assessment literacy? ii) to what extent do Jimma Zone secondary school mathematics teachers practice classroom formative assessment strategies? and iii) do teachers' assessment literacy have a significant positive impact on their formative assessment practice?

## 2. METHOD

### 2.1. Research design and participants

The study design employed in this preliminary study is a cross-sectional survey research approach. This survey is part of an ongoing PhD dissertation that includes an upcoming formative assessment intervention study. A cluster random sampling technique [44] was used to select the sample districts, schools, and participants by forming clusters of districts and schools, followed by random sampling within those clusters. As a result, the research was conducted in five district schools and three schools in Jimma Town. In total, 64 secondary school mathematics teachers participated in the study, with 82.8% male and 17.2% female. Their ages ranged from 24 to 57 years (M=34.59, SD=7.88), and their teaching experience ranged from 1 to 38 years (M=13.64, SD=8.08). Regarding their educational qualifications, 1.6% (n=1) held a diploma, 64.1% (n=41) held a BSc degree, and 34.4% (n=22) held an MSc degree.

### 2.2. Instruments and pilot testing

Regarding the research instruments, the authors adopted the already established or validated Likert-scale questionnaires with the permission of the respective authors. The instruments are the TFALS and TFAPS adopted from [11] and [12], respectively, via email permission of the authors. The TFALS consists of a total of 22 items and three subscales. The CD, PD, and SED have seven, eight, and seven items, respectively. The TFAPS has a total of 10 items and two subscales. The TdFA and SdFA with six and four items, respectively. Both instruments are six-point Likert-scale types. The response scales for the TFALS are 1) strongly disagree, 2) disagree, 3) slightly disagree, 4) slightly agree, 5) agree, and 6) strongly agree. The response scale for the TFAPS is 1) never, 2) rarely, 3) seldom, 4) sometimes, 5) frequently, and 6) very frequently. As per the reliability, the authors have already reported the reliability indices of the instruments. According to Yan and Pastore [11], the Cronbach alpha values for the CD, PD, and SED subscales of the TFALS were 0.88, 0.88, and 0.89, respectively. The TFAPS was initially developed in Hong Kong and Italian sample contexts. The combined values of Cronbach's alpha for the TdFA and SdFA subscales were 0.70 and 0.75, respectively [12].

A pilot study of the instruments was conducted to evaluate the reliability of the instruments in the current study context using 33 secondary school mathematics teachers who did not take part in this study.

The Cronbach alpha (α) reliability coefficient was computed for both instruments and their respective subscales. The alpha reliability coefficient for the total TFALS is 0.95, and α values for the CD, PD, and SED subscales, respectively, are 0.89, 0.84, and 0.88. The Cronbach alpha reliability coefficient for the total TFAPS is 0.87, and the TdFA and SdFA subscales are 79 and 0.86, respectively. Therefore, the researchers decided to use these instruments in the current study. The validity of the instruments was computed using the item-total correlation analysis technique. The Pearson r values for the TFALS ranges, r=0.40-0.85, and for the TFAP, r=0.58-0.87, are statistically significant ($p<0.05$), implying that the instruments are highly valid [45].

### 2.3. Data collection and analysis

The tasks of data collection were performed by the corresponding author and one skilled assistant data collector, DEd. Candidate in mathematics, in a face-to-face contact manner with participants in all eight sample secondary schools, using print copies of the questionnaires consisting of both TFALS and TFAPS. A hard copy of 70 questionnaires was distributed, and 65 questionnaires were returned, making the response rate 92.9%. However, one outlier data point was discarded, and finally, 64 participants were included in the data analysis. Before delving into the major data analysis, the Shapiro-Wilk normality tests have been conducted for both the TFALS and TFAPS [46]. The results show that TFALS and TFAPS were 0.965(64), p=0.065, and 0.965(64), p=0.063, respectively. The result implies that the data in both cases are normally distributed. The data analysis was done with IBM SPSS 27 software, using data analysis methods like mean, standard deviation, regression, and interval methods. According to Pimentel [47], intervals to describe a 6-point Likert-scale composite mean score are 1, strongly disagree=[1.00-1.82 (very bad)], 2, disagree=[1.83-2.65 (rather bad)], 3, slightly disagree=[2.66-3.48 (bad)], 4, slightly agree=[3.49-4.31 (slightly good)], 5, agree=[4.32-5.14 (good)], and 6, strongly agree=[5.15-6.00 (rather good)]. Moreover, the EndNote X8 referencing software was used for citation, using the IEEE referencing style.

## 3. RESULTS AND DISCUSSION

This section addresses the major study results and discussions in line with the stated research questions, based on the data obtained from 64 Jimma Zone secondary school mathematics teachers through two different survey questionnaires. These are the TFALS and TFAPS. Both instruments are a 6-point Likert scale that teacher participants rated items depending on their level of agreement with the premises or propositions.

### 3.1. The perceived level of secondary school mathematics teachers' formative assessment literacy

Table 1 shows the descriptive statistics of the perceived teacher formative assessment literacy at the scale and subscale levels. Thus, the average mean score for the total scale of the TFAL is, M=4.74(SD=0.64). At the subscale level, CD, M=4.69 (SD=0.71), PD, M=4.82 (SD=0.69), and SED, M=4.68(SD=0.78). The observed mean scores at the item, scale and subscale level correspond to the 5th interval, 4.32-5.14, proposed by Pimentel [47], which indicate medium or moderate level.

Table 1. Perceived teachers' formative assessment literacy

| SN | Construct | Items | *M* | *SD* |
|---|---|---|---|---|
| 1 | CD | 7 | 4.69 | .71 |
| 2 | PD | 8 | 4.82 | .69 |
| 3 | SED | 7 | 4.68 | .78 |
| 4 | TFAL | 22 | 4.74 | .64 |

Scales: 1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree, and 6=strongly agree (*N*=64).

As Table 1 indicates, the observed mean scores fall in the range of 4.32-5.14 [47], which is labeled as good, which corresponds to medium. Hence, the Jimma Zone secondary school mathematics teacher participants on average, assume a medium/moderate level status of perceived teacher formative assessment literacy. This result is consistent with previous research reports [21], [27], which reported Pakistani teachers have a moderate level of assessment literacy, and also consistent with [26], who reported Malaysian teachers have an average level of teacher assessment literacy. This level of teachers' assessment knowledge and skill is not sufficient for a teacher to understand formative assessment in a way that enables teachers to apply it into practice. It requires much upgrading to benefit from formative assessment. As once stated, the desired effect of formative assessment depends on teachers' comprehensive understanding and proper application of formative assessment strategies in classroom assessment practices [20].

The subscale means scores compared to the total mean (M=4.74), the practical dimension subscale mean is higher than the conceptual and socio-emotional dimensions, which are theoretically the basic knowledge aspects underlying the practical dimension, which is considered as formative assessment in practice, as in Table 1. The researchers argue that the conceptual and socio-emotional subscales are believed to be the very basic knowledge aspect of formative assessment literacy that guides the practical aspect. This may be attributed to participants' overrating of the practical part subscale may be due to what is referred to as social desirability effects [48], [49]. Otherwise, it may be due to participants' inability to grasp the concepts asked under the conceptual and socio-emotional aspects of formative assessment. To determine the perceived status of formative assessment literacy of participants, the observed mean scores were compared with other findings. Accordingly, the item-wise score range, 4.53-4.95, compared to Chinese, 4.64-4.96, context [11], indicates that the current study is much lower. Moreover, subscale-wise observed mean score in Table 1 compare to Turkey's case: CD, M=4.96, PD, M=5.02, and SED, M=5.11 [20], showing the lower level of participant teacher formative assessment literacy, which requires further improvement at any cost to a higher level.

Besides, an attempt has been made to supplement the quantitative data unscheduled class observations have been made to observe teachers' formative assessment literacy level in practice. In general, the observed teachers mostly run after content coverage using the usual way of presentation (notes and lecturing), which generally reflects teachers' lack of formative assessment literacy, even though the quantitative result indicated a moderate level. In general, the existing conditions are consistent with what Black and Wiliam [3] described, despite its substantial impact, formative assessment remained insignificant due to teachers' lack of knowledge and understanding of formative assessment. Similarly, some other researchers reported that the teachers' understanding of formative assessment is inadequate [50], and teachers' assessment practice is not formative [31]. In sum, even if the current study result, on average, shows participant mathematics teachers possess a moderate level of TFAL, classroom observation indicates teachers are not aware of formative assessment literacy. Therefore, considerable attention and effort are needed to improve the existing level to the highest possible level of formative assessment literacy, thereby benefiting from the merits of formative assessment.

### 3.2. The extent of math teachers' practice on classroom formative assessment strategies

Table 2 shows the average mean for the total scale, Practice is, M=4.67(SD=0.71); the TdFA subscale, M=4.695(SD=0.72), and the SdFA subscale, M=4.63(SD=0.80). In addition, Table 2 also shows detailed descriptive results of the five formative assessment strategies: i) clarifying learning intention and success criteria (LI), M=4.688 (SD=0.88); ii) engineering effective classroom discussions, questions, and learning tasks (DQ), M=4.703 (SD=0.80); iii) providing feedback (FB), M=4.695 (SD=0.83); iv) activating students as instructional resources for one another (PA), M=4.64 (SD=0.82); and v) activating students as the owners of their learning (SA), M=4.61 (SD=0.93). In general, in all cases the observed mean scores correspond to the 5th interval (4.32–5.14) of Pimentel [47], which is labeled as good equating moderate level. As Table 2 indicates, the observed mean scores fall in the range of 4.32-5.14 [47], which is labeled as a medium or moderate level, indicating that Jimma Zone secondary school mathematics teacher participants, on average, have a medium/moderate level of perceived teacher formative assessment practice.

Table 2. Perceived teachers' formative assessment practice

| Construct | *M* | *SD* | *Strategies* | *M* | *SD* |
|---|---|---|---|---|---|
| TdFA | 4.695 | .72 | LS | 4.69 | .88 |
| | | | DQ | 4.703 | .80 |
| | | | FB | 4.695 | .83 |
| SdFA | 4.63 | .80 | PA | 4.64 | .82 |
| | | | SA | 4.61 | .93 |
| Practice | 4.67 | .71 | | 4.667 | .71 |

NB: LS=learning intention and success criteria; QD=question and discussion, FB=feedback; PA=peer; and SA=self-assessment.
Scales: 1=never, 2=rarely, 3=seldom, 4=sometimes, 5=frequently, and 6=very frequently.

This result is consistent with previous results [40], which reported that secondary school teachers have a moderate or medium level of formative assessment practice. Besides, regarding the extent of teachers' application of formative assessment strategies in classroom assessment, the observed overall mean of teachers' formative assessment practice (M=4.667) is less than what the other reported as M=4.78 [21]. In addition, as Table 2 shows, participants performed higher on the TdFA than the SdFA subscale. This implies that the assessment process seems more concentrated on the teacher-directed formative assessment activities compared to the student-directed formative assessment activities. This result is consistent with previous

studies that reported the classroom assessment process is more dominated by teachers, minimizing students' participation [12]. It is also consistent with the previous studies that reported classroom assessment is more dominated by teachers [30], or teacher-centered [32], [42], [43], and traditional assessment methods [27], [40], [41]. Besides, Table 2 indicates that the SdFA subscale scored low, implying that teachers overlooked self-assessment or peer-assessment practices [43], and assessment practices were not formative assessment for learning [31].

As mentioned in the preceding sub-section, the unscheduled observations on teachers' application of the five formative assessment strategies rather show teachers' inclination toward the conventional assessment approach. For instance, most of the observed teachers did not share the learning intentions and success criteria before beginning the lesson, which is the first step and the main gate to formative assessment strategies. This limitation is in line with a previous study report that teachers do not address the learning intention [51]. Second, the traditional mode of presentation. Third, short time group discussion and presentation, but remain without reflection or feedback. Fourth, partial or complete absence of self and/or peer-assessment practice, the core of formative assessment. The finding is similar to what other studies reported, as teachers lack effective implementation of formative assessment [31], [43].

At the end of each class observation feedback session, however, the researchers learned that the observed teachers attributed to lack of training, shortage of time, load, class size, broadness of the text book coverage, unwillingness on behalf of students, lack of motivation or interest, absenteeism, and students' tendency to value mark than learning. These are some of the problems that require future attention for researchers, school authorities, supervisors, curriculum designers, training institutions, and concerned organizations in the Ministry of Education to benefit from the gifts of formative assessment. However, at the end of each class observation feedback session, the researchers learned that teachers attributed to lack of training, shortage of time, load, class size, broadness of the textbook coverage, unwillingness on behalf of students, lack of motivation or interest, absenteeism, and students' tendency to value mark than learning. These are some of the problems that require future attention of the researchers, school authorities, supervisors, curriculum designers, training institutions, and concerned bodies in the Ministry of Education to build teachers' capacity in formative assessment practice.

### 3.3. The relationship of formative assessment literacy and practice

Table 3 shows the regression analysis result of the impact of assessment literacy on assessment practice. The result depicted that assessment literacy significantly predicted assessment practice ($\beta$=0.67, p<0.001). Figure 1 indicates that an increase of one unit in teachers' assessment literacy results in an increase of 1.514 increase in the teachers' assessment practice ($y$=1.514+0.67). Therefore, the regression result shows teacher assessment literacy had a significant positive moderate impact on assessment practice ($R^2$=0.359, $F(1, 62)$=34.962, $p$<0.001), implying that the predictor variable explained 35.9% of the variance in practice.

The result is consistent with the previous study report [22] that reported teachers' assessment literacy has a meaningful and significant impact on assessment efficiency in the classroom. Likewise, the result is also in agreement with [23], [24], who reported that teachers' assessment literacy has a statistically significant impact on learners' writing achievements, and teachers' assessment awareness leads teaching environments to effective and motivated assessment design. Besides, the result is in line with [10], who noted that teachers' assessment practices are consistently associated with their knowledge, skills, and beliefs or their assessment literacy. This indicates that improvement in teacher formative assessment literacy will undoubtedly increase teachers' formative assessment practice. Hence, the current moderate level of formative assessment literacy and practice can be upgraded by uplifting teachers' assessment literacy through possible means of formal or informal training that would improve teachers' assessment practice to a desired level.

Table 3. Model summary for the impact of literacy on practice

| Predictor | $\beta$ | $F$ | $p$ | $R$ | $R^2$ |
|---|---|---|---|---|---|
| Constant | 1.514 | 34.692 | .007 | .599 | .359 |
| Literacy | .666 | | .000 | | |

Dependent variable: practice

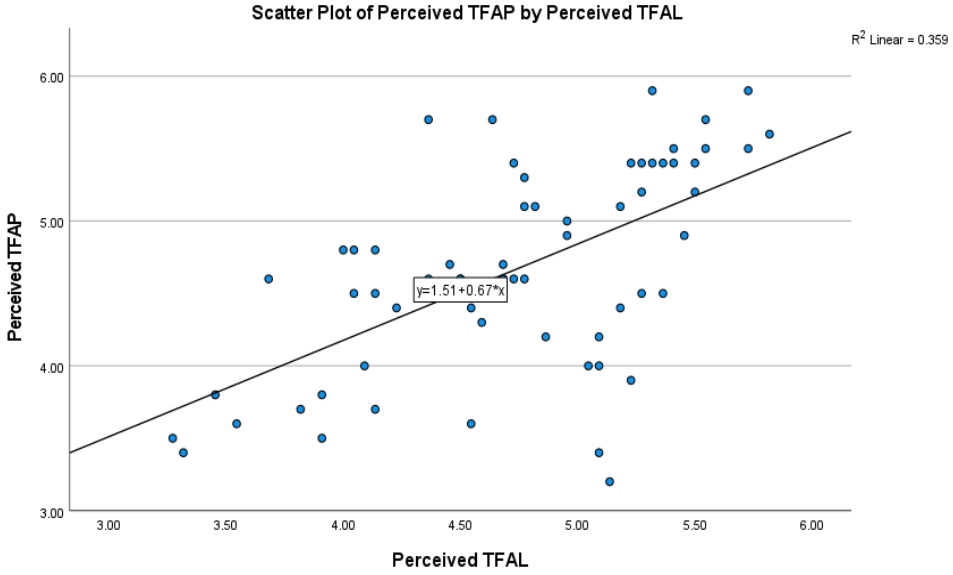


Figure 1. The linear relationship between perceived formative assessment literacy and practice

## 4. CONCLUSION

The teacher's assessment literacy is an important quality of a teacher to effectively assess student learning. Hence, this survey research was aimed at describing secondary school math teachers perceived formative assessment literacy and classroom practices using 64 randomly selected mathematics teachers. The descriptive result showed that participants have a moderate level of formative assessment literacy and practices, which require further improvement, particularly in the conceptual and socio-emotional aspects of formative assessment literacy, and the student-led formative assessment practices to fully practice classroom formative assessment strategies. The promising part of the study's findings was the impact of formative assessment literacy on teachers' classroom assessment practices. Accordingly, regression analysis indicated that teachers' formative assessment literacy resulted in a statistically significant moderate impact on teachers' classroom formative assessment practice. However, there is a need for improving the observed moderate level of teachers' formative assessment literacy via possible means to better enable teachers and students to benefit from the blessings of formative assessment practices, through consistent training interventions and professional development schemes for teachers towards formative assessment literacy and practice.

The study result has important implications for teachers with low formative assessment knowledge and skills. This highlights for the school supervisors and administrators the concept of formative assessment literacy and the areas that need more attention and improvement; trainers and training institutions in regular training or on-job short-term training; curriculum developers to pay attention to assign reasonable coverage and time for formative assessment; and more importantly to researchers who have interest to conduct research. Therefore, based on the results of the study, the researchers would like to forward some recommendations to improve the existing status of teachers' formative assessment literacy and practices. These include: i) conducting further in-depth research on teachers' FAL and FAP with ample sample sizes that include elementary school teachers from all types of subjects, reasonable coverage of the study area, and comprehensive data that include both qualitative and quantitative aspects; ii) Ministry of Education should pay enough attention to formative assessment literacy by incorporating into the curriculum along with a clear policy guide; iii) the regional and zonal education bureaus should arrange on-job training opportunities on formative assessment for secondary school math teachers; and iv) at the grass-roots level, secondary school leaders and supervisors should collaborate with nearby schools, teacher training institutions, universities, and other available non-governmental organizations working in the area to update secondary school mathematics teachers' knowledge and skill of formative assessment.

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This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

**CONFLICT OF INTEREST STATEMENT**

Authors state no conflict of interest.

**INFORMED CONSENT**

We have obtained informed consent from all individuals included in this study.

**DATA AVAILABILITY**

The data that support the findings of this study are available on request from the corresponding author, [NAMAW], upon reasonable request.

**REFERENCES**

[1] E. A. Carney, X. Zhang, A. Charsha, J. N. Taylor, and J. P. Hoshaw, "Formative assessment helps students learn over time: why aren't we paying more attention to it?" *Intersection: A Journal at the Intersection of Assessment and Learning*, vol. 4, no. 1, 2022, doi: 10.61669/001c.38391.

[2] P. Black and D. Wiliam, "Inside the black box: raising standards through classroom assessment," *Phi Delta Kappan*, vol. 92, no. 1, pp. 81–90, Sep. 2010, doi: 10.1177/003172171009200119.

[3] P. Black and D. Wiliam, "Classroom assessment and pedagogy," *Assessment in Education: Principles, Policy & Practice*, vol. 25, no. 6, pp. 551–575, Nov. 2018, doi: 10.1080/0969594X.2018.1441807.

[4] C. A. Mertler, "Teachers' assessment knowledge and their perceptions of the impact of classroom assessment professional development," *Improving Schools*, vol. 12, no. 2, pp. 101–113, 2009, doi: 10.1177/1365480209105575.

[5] American Federation of Teachers, National Council on Measurement in Education, and National Education Association, "Standards for teacher competence in educational assessment of students." U.S Department of Education Office of Educationat Research and Improvement, Washington, D.C, pp. 1–7, 1990.

[6] B. S. Plake, "Teacher assessment literacy: teacher's competencies in the educational assessment of students," *Mid-Western Educational Researcher*, vol. 6, 1993.

[7] C. DeLuca, K. Luu, Y. Sun, and D. A. Klinger, "Assessment for learning in the classroom: barriers to implementation and possibilities for teacher professional learning," *Assessment Matters*, vol. 4, pp. 5–29, 2012, doi: 10.18296/am.0104.

[8] C. DeLuca, D. LaPointe-McEwan, and U. Luhanga, "Approaches to classroom assessment inventory: a new instrument to support teacher assessment literacy," *Educational Assessment*, vol. 21, no. 4, pp. 248–266, 2016, doi: 10.1080/10627197.2016.1236677.

[9] S. Pastore and H. L. Andrade, "Teacher assessment literacy: a three-dimensional model," *Teaching and Teacher Education*, vol. 84, pp. 128–138, 2019, doi: 10.1016/j.tate.2019.05.003.

[10] T. D. Brown, M. Barnes, and I. Finefter-Rosenbluh, "Teacher perspectives and experiences of assessment literacy in Victorian junior secondary schools," *Australian Journal of Education*, vol. 68, no. 1, pp. 5–22, 2024, doi: 10.1177/00049441231214022.

[11] Z. Yan and S. Pastore, "Are teachers literate in formative assessment? the development and validation of the teacher formative assessment literacy scale," *Studies in Educational Evaluation*, vol. 74, Sep. 2022, doi: 10.1016/j.stueduc.2022.101183.

[12] Z. Yan and S. Pastore, "Assessing teachers' strategies in formative assessment: the teacher formative assessment practice scale," *Journal of Psychoeducational Assessment*, vol. 40, no. 5, pp. 592–604, 2022, doi: 10.1177/07342829221075121.

[13] D. Wiliam, C. Lee, C. Harrison, and P. Black, "Teachers developing assessment for learning: impact on student achievement," *Assessment in Education: Principles, Policy and Practice*, vol. 11, no. 1, pp. 49–65, 2004, doi: 10.1080/0969594042000208994.

[14] S. Thomas, "Assessment and evaluation of learning in a constructivist paradigm," *International Journal for Multidisciplinary Research*, vol. 5, no. 2, pp. 1–4, 2023.
[15] S. A. Sardareh and M. R. M. Saad, "A sociocultural perspective on assessment for learning: the case of a Malaysian primary school ESL context," *Procedia - Social and Behavioral Sciences*, vol. 66, pp. 343–353, 2012, doi: 10.1016/j.sbspro.2012.11.277.
[16] H. Kausar, F. Deeba, and A. Saleem, "Social constructivism: a new paradigm in teaching and learning environment," *Perennial Journal of History*, vol. 2, no. 2, pp. 403–421, 2021.
[17] L. A. Shepard, "The role of assessment in a learning culture," *Educational Researcher*, vol. 29, no. 7, pp. 4–14, 2000, doi: 10.3102/0013189X029007004.
[18] C. DeLuca, A. Coombs, S. MacGregor, and A. Rasooli, "Toward a differential and situated view of assessment literacy: studying teachers' responses to classroom assessment scenarios," *Frontiers in Education*, vol. 4, 2019, doi: 10.3389/feduc.2019.00094.
[19] F. M. Weldmeskel and D. J. Michael, "The impact of formative assessment on self-regulating learning in university classrooms," *Tuning Journal for Higher Education*, vol. 4, no. 1, 2016, doi: 10.18543/tjhe-4(1)-2016pp99-118.
[20] K. İzci, İ. İlter, and G. Izgar, "Adapting the teacher formative assessment literacy scale into Turkish: validation and reliability study," *International Journal of Assessment Tools in Education*, vol. 11, no. 1, pp. 67–87, 2024, doi: 10.21449/ijate.1343373.
[21] N. Ara and M. Saeed, "Relationship between primary school teachers' assessment literacy and classroom assessment practices," *Global Regional Review*, pp. 500–508, 2020.
[22] M. R. Rad, "The impact of EFL teachers' assessment literacy on their assessment efficiency in classroom," *Britain International of Linguistics Arts and Education (BIoLAE) Journal*, vol. 1, no. 1, pp. 9–17, 2019, doi: 10.33258/biolae.v1i1.14.
[23] M. Mellati and M. Khademi, "Exploring teachers' assessment literacy: impact on learners' writing achievements and implications for teacher development," *Australian Journal of Teacher Education*, vol. 43, no. 6, pp. 1–18, 2018, doi: 10.14221/ajte.2018v43n6.1.
[24] M. T. Hidayat, "Teachers' assessment literacy impact on learners' writing achievements," *English Education and Applied Linguistics Journal (EEAL Journal)*, vol. 3, no. 2, pp. 107–117, 2020, doi: 10.31980/eealjournal.v3i2.1838.
[25] S. Luitel, "The status of assessment literacy and classroom practice of secondary level teachers," *Interdisciplinary Research in Education*, vol. 6, no. 1, pp. 115–124, 2021, doi: 10.3126/ire.v6i1.43428.
[26] N. B. Muhammad, N. B. M. Ali, S. B. Zamani, N. A. B. Yamin, and N. N. B. Ismail, "Examining assessment literacy : a study of technical teacher," *European Journal of Molecular & Clinical Medicine*, vol. 07, no. 08, pp. 705–717, 2020.
[27] F. N. Khan, S. Hussain, and M. Imad, "Classroom assessment, literacy and practices of teacher educators in Pakistan," *Global Social Sciences Review*, vol. IV, no. IV, pp. 45–51, 2019, doi: 10.31703/gssr.2019(iv-iv).07.
[28] I. B. G. Nyudak, N. L. P. E. S. Dewi, and A. A. G. Y. Paramarth, "Assessment literacy of EFL teachers in Badung, Bali, Indonesia: conception and and practices," *ELT Worldwide: Journal of English Language Teaching*, vol. 9, no. 1, pp. 178–187, 2021.
[29] P. Akayuure, "Classroom assessment literacy levels of mathematics teachers in Ghanaian senior high schools," *Contemporary Mathematics and Science Education*, vol. 2, no. 2, 2021, doi: 10.30935/conmaths/11286.
[30] D. B. Gurmesa, D. T. Birbirs, J. W. Hussein, and A. G. Tsegaye, "Ethiopian secondary school EFL teachers' classroom assessment conceptions and practices from an activity theory perspectives," *East African Journal of Education Studies*, vol. 5, no. 1, pp. 105–116, 2022, doi: 10.37284/eajes.5.1.574.
[31] B. K. Ochour, P. Opoku-Afriyie, and I. Eshun, "Formative assessment conceptions and practices of junior high school social studies teachers in the techiman municipality of Ghana," *Universal Journal of Social Sciences and Humanities*, vol. 2, no. 4, pp. 273–290, 2022, doi: 10.31586/ujssh.2022.557.
[32] M. A. Vlachou, "Classroom assessment practices in middle school science lessons: a study among Greek science teachers," *Cogent Education*, vol. 5, no. 1, 2018, doi: 10.1080/2331186X.2018.1455633.
[33] R. Aslam and N. Khan, "Secondary school teachers' knowledge and practices about constructive feedback: evidence from karachi, pakistan," *Cakrawala Pendidikan*, vol. 40, no. 2, pp. 532–543, 2021, doi: 10.21831/cp.v40i2.35190.
[34] T. Ombay, S. Kikomelo, and W. Daniel, "Secondary school biology teachers' knowledge and practices of formative assessment in Tanzania," *Central European Journal of Educational Research*, vol. 6, no. 1, pp. 10–19, 2024, doi: 10.37441/cejer/2024/6/1/13389.
[35] O. A. Osumah and T. I. Asekomhe, "Knowledge of formative assessment practices of teachers in public senior secondary schools in Edo Central Senatorial District, Nigeria," *International Journal of Innovative Science and Research Technology*, vol. 8, no. 4, pp. 610–615, 2023, doi: 10.5281/zenodo.7867450.
[36] M. Rajendran, "Sociocultural perspective on assessment for learning: exploring pre-service teachers' understanding," *International Journal of Social Science And Human Research*, vol. 05, no. 10, pp. 4567–4570, 2022, doi: 10.47191/ijsshr/v5-i10-21.
[37] D. Aria, D. Sukyadi, and E. Kurniawan, "Teacher assessment literacy: Indonesian EFL secondary teachers' self-perceived on classroom-based assessment practice," *English Review: Journal of English Education*, vol. 10, no. 1, pp. 15–26, 2021, doi: 10.25134/erjee.v10i1.5349.
[38] B. R. Acharya, "Assessment practices in mathematics courses: towards dialectical positioning," *Interdisciplinary Research in Education*, vol. 4, no. 2, pp. 149–161, 2019, doi: 10.3126/ire.v4i2.27932.
[39] C. Lelisa, "Secondary school teachers' classroom assessment practices," *Science, Technology and Arts Research Journal,* vol. 10, no. 1, pp. 41-56, 2021. doi: 10.20372/star.v10i1.04
[40] L. Moges Mengesha and S. Zerfu Degefa, "Assessment practices of secondary school mathematics teachers in Guraghe Zone," *Pure and Applied Mathematics Journal*, vol. 10, no. 3, p. 77, 2021, doi: 10.11648/j.pamj.20211003.12.
[41] S. Osman, "Basic school teachers' assessment practices in the Sissala East Municipality, Ghana," *European Journal of Education Studies*, vol. 8, no. 7, 2021, doi: 10.46827/ejes.v8i7.3801.
[42] A. B. M. Sheikh and M. N. A. Manap, "Classroom assessment practices," *Open Journal of Social Sciences*, vol. 12, no. 03, pp. 239–258, 2024, doi: 10.4236/jss.2024.123018.
[43] Ö. Yildirim and S. B. Demir, "Inside the black box: do teachers practice assessment as learning?" *International Journal of Assessment Tools in Education*, vol. 9, no. Special Issue, pp. 46–71, 2022, doi: 10.21449/ijate.1132923.
[44] J. W. Creswell and V. L. Plano Clark, *Designing and conducting mixed methods research*. 3rd ed. Thousand Oaks: SAGE, 2018.
[45] R. Oktavia, I. Irwandi, T. Rajibussalim, M. Mentari, and I. S. Mulia, "Assessing the validity and reliability of questionnaires on the implementation of Indonesian curriculum K-13 in STEM education," *Journal of Physics: Conference Series*, vol. 1088, 2018, doi: 10.1088/1742-6596/1088/1/012014.
[46] "Discovering statistics using SPSS".
[47] J. L. Pimentel, "Some biases in likert scaling usage and its correction," *International Journal of Sciences Basic and Applied Research*, vol. 45, no. 1, pp. 183–191, 2019.

[48] F. A. Setiawati, T. Widyastuti, K. N. Fathiyah, and T. S. Nabila, "Minimizing social desirability in questionnaires of non-cognitive measurements," *European Journal of Psychology and Educational Research*, vol. volume-7-2, no. volume-7-issue-1-march-2024, pp. 33–43, 2024, doi: 10.12973/ejper.7.1.33.
[49] K. Lavidas, S. Papadakis, D. Manesis, A. S. Grigoriadou, and V. Gialamas, "The effects of social desirability on students' self-reports in two social contexts: lectures vs. lectures and lab classes," *Information (Switzerland)*, vol. 13, no. 10, 2022, doi: 10.3390/info13100491.
[50] M. A. Arrafii and B. Sumarni, "Teachers' understanding of formative assessment," *Lingua Cultura*, vol. 12, no. 1, p. 45, 2018, doi: 10.21512/lc.v12i1.2113.
[51] H. Crichton and A. McDaid, "Learning intentions and success criteria: learners' and teachers' views," *Curriculum Journal*, vol. 27, no. 2, pp. 190–203, 2016, doi: 10.1080/09585176.2015.1103278.

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