

Assessment Literacy : A Systematic Literature Review & Research Agenda

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Abstract

Assessment literacy is characterised as teachers ability to recognise and understand clearly the fundamental concepts of assessments, while being able to conduct the testing, scoring and analysing processes, followed by the interpretation of assessment findings and follow-up actions, in reporting the overall level of student achievement, done continuously over a period of time, aimed to obtain feedbacks to be used to generate good performance among students. This article is written to identify the development of previous studies related to assessment literacy with co-citation analysis. The key purposes of this analysis are (1) to classify the key sources and classes they form (i.e. clusters), and (2) to elaborate on the relevance of the topics frequently discussed by the authors in studies related to assessment literacy. The articles reviewed were identified using the Scopus search engine. The data obtained were analyzed using VOSviewer software to produce bibliometric analysis. This systematic literature review focuses on assessment literacy studies related to the discussion of educational activities. The results can be categorized into six main groups namely (1) Changes in the education assessment system and the confidence of prospective teachers in implementing it, (2) The need for assessment concepts, (3) Literacy & interpretation of teacher data, (4) Assessment literacy and international needs, (5) Factors influencing teacher assessment, and (6) Methods of improving teacher assessment literacy in learning. This article analysis attempts to lead to a more comprehensive understanding of research topic growth, scientific practice, and trends in new and exciting fields of study.

INTRODUCTION.

A quality teaching and learning process enables continual enhancement of student learning outcomes. A quality of teaching and learning depends highly on the teacher's quality of teaching (Yamtim & Wongwanich, 2014) and the teacher's quality of teaching closely related to the quality of assessments conducted in the classroom (Khadijeh & Amir, 2015). The importance of assessment in a teaching and learning cycle is supported by Stiggins (1999) who stated that the estimated time spent by a teacher in conducting assessment activities in the classroom is 50%. Similarly, Plake (1993) had previously mentioned that each teacher uses one third to half teaching time to conduct classroom assessments. This statement is enough to prove that assessment activities are crucial in

Comment [Moon1]: Depends on the teacher as an individual or the quality of teaching?

teaching and learning and are needed as the main determinant of the success of a teaching and learning process.

Assessment is any interpretation based on student performance knowledge, which is obtained by a number of methods or practises (Messick, 1989). Thomas et al., (2004) argues that appraisal practises will help teachers and students in a variety of ways, for example 1) provide information to teachers about students' learning and teaching adaptation 2) help teachers monitor students' learning continuously (throughout the year) before the end of year assessment 3) help teachers provide information in determining appropriate teaching methods 4) Enable feedback to be given immediately to students on their learning if assessment is done continuously 5) Encourage students to understand the appraisal is part of the process and enhance learning 6) Help students determine mastery of concepts and skills 7) Prepare students to face higher standard tests because they are familiar with the assessment format.

Teacher's assessment literacy acts as a link between the quality of assessment and students' achievement(Ashraf & Zolfaghari, 2018; Mellati & Khademi, 2018; Zolfaghari & Ahmadi, 2016). Effective assessment literacy may help teachers perceive, evaluate, interpret and use student achievement data to recognise their instructional needs. All these feedback should be used to increase the level of teaching and learning(Ashraf & Zolfaghari, 2018; Pastore & Andrade, 2019; Yamtim & Wongwanich, 2014). Therefore, the development of teacher assessment literacy is essential to ensure the development of quality teaching and learning. Nevertheless, based on previous findings, teachers' assessment literacy is still low(DeLuca & Bellara, 2013; Yamtim & Wongwanich, 2014), insufficient(Jawhar & Subahi, 2020; Tzu-Hua Wang et al., 2008) and is an issue of a global nature(Lam, 2019)although it is considered important among teachers at all levels of education(Jawhar & Subahi, 2020).

The significance of teacher assessment literacy has long been widely recognized as an important issue and related studies are still actively being carried out to date (Edwards, 2020; Qotboddin Jan-nesar M. et al., 2020). A number of researches were done to verify and understand teacher assessment literacy(Jawhar & Subahi, 2020), yet, most studies only focused on the level, preparation and training among teachers such as mentioned inPlake et al. (1993), Mertler (2003),DeLuca et al. (2016)andPastore & Andrade, (2019). Existing studies related to systematic literature review (SLR) are still scarce. Some of SLR have been conducted byGotch & French (2014) and DeLuca et al. (2015), who conducted an SLR or review article which focused on assessment literacy initiatives under current teacher assessment strategy, whileIslam & Bt Stapa (2019) surveyed the recent research focuses on the progress of student transition assessments into learning. Nevertheless, despite the various studies n teacher assessment literacy, no SLR has been conducted on the topic of assessment literacy through bibliometric techniques. Therefore, this study aims to fill in this gap, related to assessment literacy studies.

PURPOSE OF THE STUDY

This article focuses on co-citation analysis that allows cluster compositions to be obtained. Thesenetworks of quotations provide information on the most important areas of related topics through collaboration between collections of articles or specific research

paradigms (Garfield, 2001). Besides contributing to the Systematic Literature Review (SLR) that focuses on assessment literacy, this current study helps to present future research agendas based on the questions raised. Furthermore, this research allows emerging ones to be discussed and illustrated literature on studies related to assessment literacy. Therefore, this study's main objectives are (1) to classify the relevant sources and groups (i.e. clusters) formed and (2) discussed the relevance of the topics often discussed by the authors in the studies related to assessment literacy.

The literary review takes a systematic approach, with strict guidelines and descriptions of measures for literature research and analysis based on scientific papers published in Scopus. 1150 articles which were related to assessment literacy have been submitted for bibliometric analysis. This article concentrates on two approaches, namely (1) Discussing the methodology used by the author as well as a discussion of the results of the study and (2) Discussing on the focus of future research topics presented in the last section.

BACKGROUND OF STUDY

3.1 Assessment literacy

Assessment literature is quite broad and continuously growing (Fulmer et al., 2015) and literacy assessment is a branch to it which is considered essential for modern teaching (Deneen & Brown, 2016). There are four essential components of assessment especially in the classroom namely 1) purpose 2) measurement 3) evaluation and 4) use (McMillan, 2011). Purpose is the first step in an assessment which clarifies the specific purpose or purpose of gathering the information; measurement is a systematic process of assigning numbers to behavior or performance; evaluation is a process to place some degree of value and observations based on a specific frame of reference; and use is how the evaluations are carried out (McMillan, 2011). All these components are key ideas in assessment and the relationship between them refers to assessment knowledge (Fulmer et al., 2015) while the ability to apply these knowledge in evaluating, designing and executing appraisal activities is called as assessment literacy (Stiggins, 1995). Therefore, Fullan & Watson (2000) defined that assessment literacy does not refer to the ability alone, but it incorporates teachers' ability to check, understand work results and interpret students' performance data aimed at developing the classroom and school planning as well as changing the situation if necessary to achieve better results.

3.2 Assessment literacy studies & issues

Teacher assessment literacy is important as the main link between assessment quality and student achievement (Ashraf & Zolfaghari, 2018; Mellati & Khademi, 2018; Zolfaghari & Ahmadi, 2016). Due to this reason, it is a major concern and has proven to have an impact on school performance (Lian et al., 2014), and related studies are still actively conducted (Edwards, 2020; Qotboddin Jan-nesar M. et al., 2020). Previous studies have shown that classroom assessment literacy is a global issue (Lam, 2019) and important among teachers at all levels of education (Jawhar & Subahi, 2020). Nevertheless, studies on this concept remain scarce (DeLuca & Bellara, 2013; Yamtim & Wongwanich, 2014) and

insufficient (Jawhar & Subahi, 2020; Tzu-Hua Wang et al., 2008). In Ukraine for example, teachers and students consider that testing in the classroom during the teaching and learning process is a nuisance (Ukrayinska, 2018). In United States, research findings showed that 50% of accreditation services do not have assessment training, resulting in teachers not having significant ability in performing assessment tasks in the classroom (Plake & Impara, 1997) as well as still practicing educational evaluation orientation that is different from proper classroom assessment (DeLuca et al., 2016). The same thing occurs in Thailand when teacher professional training is mostly related to administration of locally and nationally exams that doesn't improve teachers' knowledge and skills on student assessment (Yamtim & Wongwanich, 2014). Language teachers in Iraq were found unprepared to assess student performance when surveys showed that their assessment literacy levels were low / weak and needed for improvement (Hama Najib Muhammad & BARDAKÇI, 2019). Similar findings were found in Saudi (Jawhar & Subahi, 2020). Furthermore, assessment literacy studies in Israel showed that teacher classroom assessment practices in schools are only at a moderate level (Levy-Vered & Nasser-Abu Alhija, 2015). Based on the examples of the above countries, it is clear that the issue of classroom assessment is a global problem experienced by teachers around the world.

METHODOLOGY

This systematic study is revolves around academic research found on the topic of assessment literacy. It is article network based that shares on keywords and author relationship to make enriched intelligence layers designed for societies (Zhang & Chen, 2020). VOSviewer software version 1.6.13 was used in this systematic review. The software is capable of supporting ris and csv formats from the Scopus database to build bibliometric maps, identify clusters and reference networks in studies related to studies on assessment literacy (Perianes-Rodriguez et al., 2016; van Eck & Waltman, 2010; Waltman et al., 2010).

The search process includes literature from articles, book chapters, reviews, conference papers, editorials, notes, short surveys and undefined related document types performed in the Scopus Index database and focuses on Social Science subject area only. However, it is limited to reviewing journal papers, chapters and scholarly books are only written in English. Unpublished theses, dissertations and articles as well as ineligible sources are not included. Reports not available in complete texts and studies on other stakeholders' assessment literacy (e.g., students, testers) are also exempt. Therefore, the scope of this survey may not be complete, but it is considered appropriate for field description. Selection of the Scopus Index database is due to having an extensive network of journals covering publications from 1991 till today. The keyword strategies ALL ("assessment literacy") AND (LIMIT-TO (SUBJAREA, "SOCI")) in all fields have been used and yielded a total of 1055 documents related to topics and subject areas. The search was done on 9 September 2019. Figure 1 indicates Mascarenhas et al. (2018) proposed study protocol.

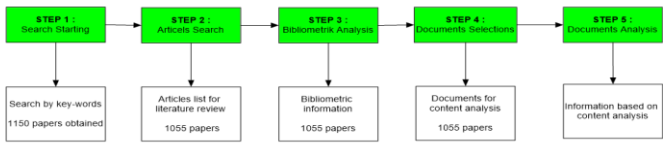


Figure 1. Search protocol (Mascarenhas et al., 2018).

RESULT AND FINDING

5.1 Publication And Citations

Figure 2 indicates the number of publications and citations developing between 1991 and 2020 from 1055 papers. Citations have dramatically risen to a high of 1412 citations by 2011. The number of citations decreased significantly after 2011 to 2020 with the number of citations being 82. However, from 1993 to 2020, the number of publications continued to grow. The first article was published in 1991, increased horizontally to 2009 and increased significantly after 2009. By 2020, the maximum number of publications reached 165 publications. Based on Figure 3, the maximum number of publications on assessment literacy in the field of Social Sciences is 1055 documents followed by other fields such as Arts & Humanities and Computers Sciences.

From 1055 documents found, 319 (30.24%) did not have any citations and 736 (69.76%) had citations. The ten most common articles which are commonly referred to by other researchers are listed in Table 1. These ten articles discuss various topics such as approach to desingning, implementing and evaluating problem and project based learning(Barron et al., 1998), the advancement technology in assessment(Chu, 2014; Gikandi et al., 2011; Hwang & Chang, 2011), new forms of student assessment(Wolf et al., 1991), teacher practices and conception of assessment(Brown, 2004; McMillan et al., 2002; Popham, 2009),current standard and conceptions of assessment (Brookhart, 2011)and factors that facilitated and impeded the teacher from implementing the assessment process(Borko et al., 1997). Most articles present quantitative studies and some use qualitative methodologies. In addition, there are also some articles in the form of scholarly writing and not in the form of research. Therefore, the design of the study is not stated here.

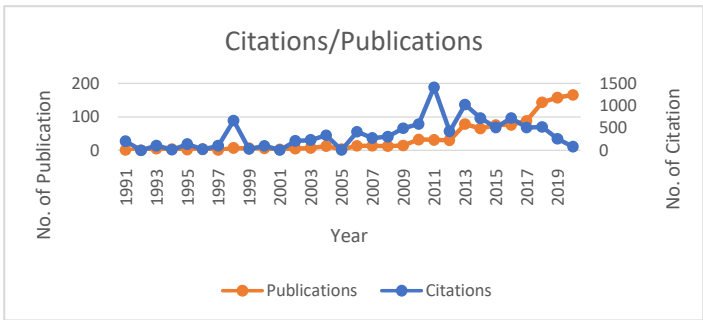


Figure 2. Total publications and citations by year.

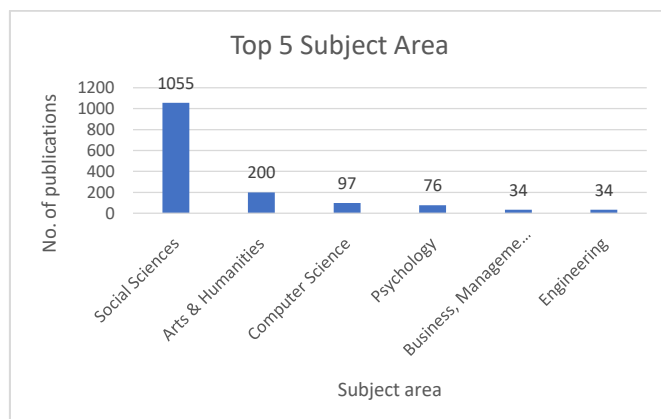


Figure 3. Number of papers published by research field.

Table 1 : Top ten most cited articles.

Article	Author/Year	Journal	Total citations	Methodology/Type
Doing with Understanding: Lessons from Research on Problem- and Project-Based Learning.	(Barron et al., 1998)	Journal of the Learning Sciences	599	General Article Mix Method
A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students	(Hwang & Chang, 2011)	Computers and Education	411	Quantitative
Online formative assessment in higher education: A review of the literature	(Gikandi et al., 2011)	Computers and Education	327	Qualitative
Chapter 2: To Use Their Minds Well: Investigating New Forms of Student Assessment	(Wolf et al., 1991)	Review of Research in Education	204	Quantitative
Teachers' conceptions of assessment: Implications for policy and	(Brown, 2004)	Assessment in Education: Principles,	172	Mix Method

professional development		Policy and Practice		
Assessment literacy for teachers: Faddish or fundamental?	(Popham, 2009)	Theory into Practice	139	General Article
Potential negative effects of mobile learning on students' learning achievement and cognitive load-a format assessment perspective	(Chu, 2014)	Educational Technology and Society	115	Quantitative
Elementary teachers' classroom assessment and grading practices	(McMillan et al., 2002)	Journal of Educational Research	113	Quantitative
Educational Assessment Knowledge and Skills for Teachers	(Brookhart, 2011)	Educational Measurement: Issues and Practice	106	General Article
Teachers' developing ideas and practices about mathematics performance assessment: Successes, stumbling blocks, and implications for professional development	(Borko et al., 1997)	Teaching and Teacher Education	102	Qualitative

5.2 Document Analysis

5.2.1 Documents Analysis Co-Occurrence By Keywords

This systematic literature review was conducted through document analysis with full counting, with a minimum of five occurrences of the keywords. Based on the number of occurrences, seven clusters (Figure 4) were yielded as discussed as below.

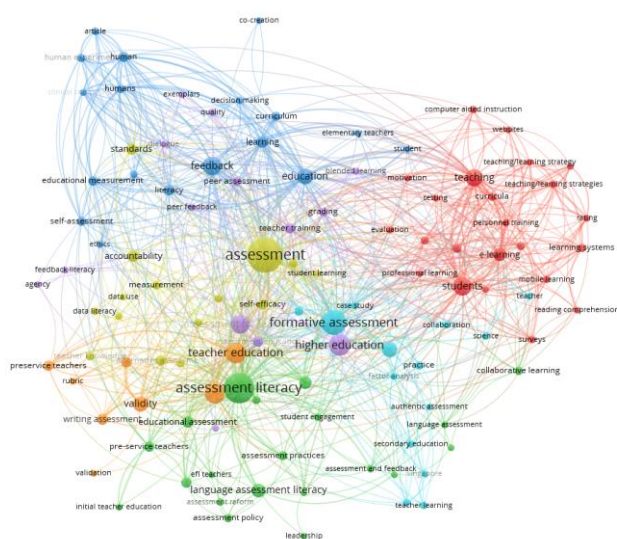


Figure 4 :The analysis of keywords in all fields with a minimum number of five times co-occurrences in each Scopus documents .

5.2.1.1 Cluster One-23 Items

According to Figure 4, the highest number of occurrences based on keywords are: students, teaching and e-learning which show a very strong relationship between these three keywords in the topic of research. Students, teaching and e-learning are closely related in any education system. If these three positions are analysed, the keyword 'students' is closely related with e-learning compared to the teaching position. This indicates that students and e-learning are strongly related in social science researches compared to 'teaching'. This is further proven by the total link strength of more than 120, compared to only 71 link strength for 'teaching' and 'students'. In terms of number of occurrences, size of teaching also showed the smallest number of occurrence compared to students and e-learning. In addition, another term in this cluster, namely 'teacher assessment literacy' yielded less than 10 number of occurrences with link of strength between 35 to 10 respectively. This interrelation and the connection is too weak, and considered insignificant in this cluster.

5.2.1.2. Cluster Two-20 Items

In the second cluster, assessment literacy had a higher frequency. In terms of the number of occurrences, size of assessment literacy is quite big (96) compared to other terms in this clusters (Figure 4). This clearly illustrates assessment literacy as a core concept in this cluster. It is followed by language assessment literacy, summative assessment, educational assessment, conceptions of assessment and pre-service teachers which occurred between 11 to 20 times compared to other terms, which had less than 10 occurrences.

5.2.1.3. Cluster Three-18 Items

Feedback, education and learning were the top three occurrences in the third cluster (Figure 4). Education was found to have the highest link strength compared to feedback and learning with link strength of 112, 88 and 64 respectively. This is due to the fact that 'education' is a common topic particularly in social sciences, highly relevant and had been widely discussed. Although education has a high total link of strength, the occurrence of 'feedback' was the highest in the discussions on assessment literacy discussion with 35 occurrences compared to 27 occurrences in education. In this cluster; clinical competence, co-creation, elementary teachers, ethics and students had the least number of occurrence and are located far from the center of the main clusters.

5.2.1.4. Cluster Four-15 Items

In the fourth cluster, the term assessment showed the highest occurrence with 127 occurrences. It is located at the center and also observed to have the highest strength with 227 link of strength. This shows that in most assessment literacy studies, the term assessment occurred the most. In this same cluster, the term pedagogy was found to be closely related to the term assessment, followed by student learning, self-efficacy and teacher preparation. However, it was found that the term data literacy in this cluster did not show a direct relationship with the term assessment, with the total link of strength of 12 and 10 respectively.

5.2.1.5. Cluster Five-14 Items

In this fifth cluster, two terms namely 'higher education' and 'assessment for learning' were found to be closely related compared with other terms. These two terms also have a big circle indicating that they are dominant terms in this clusters, with each represented by 47 and 36 total number of occurrences respectively. It is followed by the terms 'assessment education' and 'teacher training' with the total number of occurrences being 11, while other terms had less than 10 number of occurrences. Some of terms such as agency, dialogue, exemplars, quality and blended learning are scattered and not closely linked. This indicates that the frequency of the terms being discussed together is very low.

5.2.1.6. Cluster Six-14 Items

In the sixth cluster, the terms 'formative assessment' had the biggest circle with a total of 63 occurrences and 98 total link of strength. This circle of terms is the third biggest after assessment literacy and assessment. This indicates that the terms formative assessment is always used and closely related with these two terms in most researches. The term 'professional development' is the second highest with a total of 23 number of occurrences in this cluster but is located quite far from term formative assessment compared with the terms case study and teachers. From this network, it can be observed that there are some terms that are commonly linked or cited together with professional development such as case study,

collaboration, authentic assessment, teacher learning and Singapore. The term Singapore showed a prominent occurrence because there was one article / research in that country which had a total of 5 occurrences and 98 total link of strength(fifth lowest in this cluster).

5.2.1.7. Cluster Seven-8 Items

In the seventh cluster, only eight terms were found to be prominent namely teacher education, classroom assessment, validity, writing assessment, reliability, preservice teachers, rubric and validation. Teacher education, classroom assessment and validity are the top three terms in this cluster represented by 45, 40 and 23 total number of occurrences and 81, 52 and 50 total link of strength respectively. All the terms in this cluster are scattered and not closely linked and the number of occurrences the terms are discussed together is very low. The circle of the term reliability is smaller than validity represented by 12 and 23 total number of occurrences and 29 and 50 total link of strength respectively. This indicates that most studies of the assessment literacy topic was on validity rather than reliability in terms of psychometric characteristics.

5.2.2 Document Analysis Co-Authorship By Authors

To identify the authors' tendency when conducting studies on assessment literacy, this study is divided into clusters. Reference description analysis is done based on the minimum of 3 documents by an author which has yielded six clusters (see Figure 3) involving 478 publications with 112 authors. Clusters are formed in strong communities that are intertwined, co-developed (Li et al., 2010) and have more knots or relationships in their own community than other communities (Radicchi et al., 2004). This study only discusses the top three articles based on the highest number of citations to gain insights into the topic of discussion for each cluster. The clusters are: (1) Changes in the education assessment system and the confidence of prospective teachers in implementing it, (2) The need for assessment concepts, (3) Literacy, teacher data interpretation, (4) Assessment literacy and international needs, (5) Factors that influence teacher assessment, and (6) Methods of improving teacher assessment literacy in teaching and learning.

5.2.2.1 Cluster one: Changes in the education assessment system and the confidence of prospective teachers in implementing it.

The first cluster is the largest group in the study discussing the topic of assessment literacy. This cluster further discusses the changes in the education assessment system and the confidence of prospective teachers in implementing it. Table 2 summarises the top five of the most cited authors in the first cluster.

Recent changes in the standardized assessment system in education have led to an increase in teacher competency requirements in the field of student measurement and assessment (Deluca & Klinger, 2010). This includes aspects of teacher assessment practices, theory, and philosophy. The study by Deluca & Klinger (2010) showed that the findings support the teachers' needs in implementing assessment with specific topics such as reporting

achievement, changing assessments, developing response-constructed items, item reliability, validity, articulating evaluation philosophy and others that are important in teacher assessment literacy. Preservice teachers are seen as the main focus of previous studies to undergo assessment training programs before implementing them in schools.

These changes in the assessment of education have led to changes in education policies and guidelines at various levels. It aims to improve teacher assessment competencies by focusing on preservice teacher assessment education. DeLuca & Bellara (2013) stated that coordination analysis between accreditation for teacher education policy, technical requirements for teacher assessment practice and the curriculum for preservice evaluation courses is necessary to ensure that assessment education is in accordance with classroom practice. Coordination and mismatch across current assessment education policies, standards, and curriculum can lead to implications for teacher readiness of this assessment and the future of assessment education research.

Assessment education can increase the level of assessment literacy which is also a fundamental requirement of the teaching profession. As such, the need to measure and support teacher assessment literacy has been a significant priority over the past two decades and there are many standardized assessments around the world, representing different concepts of assessment literacy (DeLuca et al., 2015). Studies showed that there is a shift in the assessment landscape from the perspective of the development of assessment standards and measurement of assessment literacy from time to time after 1990. Despite the significant shifts in assessment literacy standards over time, it largely continued to be based on the initial (original) concept of assessment literacy (DeLuca et al., 2015). As a result of the development of standards and measurements, the latest dimensions of assessment literacy can be used to measure teacher assessment literacy.

Table 2 : Top five most cited articles in cluster one.

Article	Author/Year	Journal	Total citations	Methodology
Assessment literacy development: Identifying gaps in teacher Candidates' learning	(DeLuca & Klinger, 2010)	Assessment in Education: Principles, Policy and Practice	93	Quantitative
The Current State of Assessment Education: Aligning Policy, Standards, and Teacher Education Curriculum	(DeLuca & Bellara, 2013)	Journal of Teacher Education	58	Qualitative
Teacher assessment literacy: a review of international standards and measures	(DeLuca et al., 2015)	Educational Assessment, Evaluation and Accountability	40	Mix Method

Establishing a foundation for valid teacher judgement on student learning: The role of pre-service assessment education	(DeLuca, Chavez, & Cao, 2013)	Establishing a foundation for valid teacher judgement on student learning: The role of pre-service assessment education.	25	Quantitative
Pedagogies for Preservice Assessment Education: Supporting Teacher Candidates' Assessment Literacy Development	(DeLuca, Chavez, Bellara, et al., 2013)	Teacher Educator	23	Qualitative

5.2.2.2 Cluster two: *The need for assessment concepts.*

The papers belonging to the second identified cluster are shown in table 3. This is closely related to the discussion of concepts to assessment literacy.

According to Brown (2004) there are four concepts of assessment namely (a) improving teaching and learning, (b) school accountability, (c) student accountability and (d) considering irrelevant assessments that need to be understood by teachers. The four main concepts of assessment analyzed with structural equation modeling have shown a close fit of the data to a hierarchical, multi-dimensional model. Most respondents stated that they did not agree that the concept of assessment was for the responsibility of students and rejected the view that assessment was not relevant, but accepted the concept of school improvement and accountability. The three concepts of improving teaching and learning, school accountability and student accountability showed a positive correlation. Moreover, the concepts assume that irrelevant assessment is inversely related to the concept of improving teaching and learning and is not related to the concept of accountability system. Teacher variables (age, gender, role, assessment training, or assessment) or school (size, location, or socio-economic status) showed no statistically significant difference in mean scale scores for each conception.

Xu & Brown (2016) reconceptualized teacher assessment literacy by linking two areas namely educational assessment and teacher education. They have introduced a new conceptual framework, namely teacher assessment literacy in practice (TALiP) which connects various components by multi-direction arrow in pyramid diagram. The basic components of TALiP is the knowledge based, followed by interpretive & guiding framework, teacher concepts of assessment, macro social-cultural & mikro institutional contexts, teacher assessment literacy in practice, teacher learning and assessor identify (re) construction. There are three levels of mastery in TALiP which are basic comprehension of knowledge in educational assessment, an internalised collection of knowledge and skills of assessment interconnectedness, teaching & learning and a self-directed understanding of assessment processes and one's own identity as an assessor. This conceptual framework can be used to increase the level of teacher assessment literacy i.e. focus is given more on basic

knowledge, even for more dynamic and evolving system considerations. Teachers always compromise between competing systematic tensions as suggested by TALiP with the joint efforts of stakeholders.

Remesal (2011) stated that there are four dimensions of the impact of the implementation of assessment, namely (a) teaching, (b) learning, (c) teacher responsibility and (d) other stakeholders. A conceptual framework model of the impact of the implementation of assessment on these four dimensions has been introduced by Remesal (2011). These four dimensions that give an uneven effect which depend on the tendencies that may be related such as the intrinsic tension of pedagogical and social assessment functions in schools as well as the difficulty of implementing assessments for instructional methods. The concept of teacher assessment is related to the framework of the education system, regardless of whether it tends toward pedagogy or accreditation related to the criteria of external assessment of classrooms. In addition, the concept of teacher assessment function may be structured differently, beliefs about the role of assessment in teaching and learning is separately considered. This will clarify the difficulty of performing assessments for innovative learning practices.

Table 3 : Top five most cited articles in cluster two.

Article	Author/Year	Journal	Total citations	Methodology/Type
Teachers' conceptions of assessment: Implications for policy and professional development	(Brown, 2004)	Assessment in Education: Principles, Policy and Practice	172	Quantitative
Teacher assessment literacy in practice: A reconceptualization	(Xu & Brown, 2016)	Teaching and Teacher Education	87	Qualitative
Primary and secondary teachers' conceptions of assessment: A qualitative study	(Remesal, 2011)	Teaching and Teacher Education	60	Qualitative
Conceptions of Assessment: Understanding What Assessment Means to Teachers and Students	(Brown, 2008)	Conceptions of Assessment: Understanding What Assessment Means to Teachers and Students	57	BOOK
Prospective Teachers' Conceptions of Assessment: A cross-	(Brown & Remesal, 2012)	Spanish Journal of Psychology	40	Qualitative

cultural comparison				
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5.2.2.3 Cluster three: Literacy, teacher data interpretation.

In the third cluster the authors focus on discussions related to data literacy and teacher data interpretation (Table 4).

The use of data has been strongly emphasized in education but few educators have been educated or trained in data literacy skills (Mandinach & Gummer, 2016b). In Mandinach & Gummer (2016b), they discussed a structure for identifying relevant knowledge, skills and dispositions teachers effective and responsible use of data. This article discusses seven primary fields of knowledge that include the use of data in the investigative process namely: content knowledge; general pedagogical knowledge; curriculum knowledge; pedagogical content knowledge; knowledge of learners and their characteristics; knowledge of educational contexts; and knowledge of educational ends, purposes and values. The usage of knowledge consists of five components for the teaching domain that relate specific knowledge and skills, namely: identify problems and frame questions, use data, transform data into information, transform information into a decision, and evaluate outcomes. Changes often occur depending on the current needs of teacher data circulation and it needs to be integrated into the curriculum as well as practical experience for teacher preparation programs.

Proper interpretation of the score report is a necessary prerequisite to successfully complete all phases. It is necessary to make the right decision. However, correctly translated report scores do not necessarily guarantee adaptation for the process of learning. This requires assessment literacy that is not only limited to the analysis of correct test findings, but also the capacity to transform data feedback into more meaningful teaching actions. The production of student monitoring reports based on computer programs such as LOVS (program encompasses various tests in the Netherlands) is often used in providing reliable and objective input from data to educators. Nevertheless, research shows that several users faced problems and often struggle to not be able to fully interpret the data correctly. Contextual factors (e.g. time, assessment literacy, support and stress) also influence the degree to which the report is interpreted correctly. Therefore, the test of a computer program developer like this should ensure that the test results can be used as intended so that the report will be interpreted more accurately to provide reliable and valid information (van der Kleij & Eggen, 2013).

Teachers should know how to use the data. The data generated include various sources involving behavioral data of motivation, attitudes, attendance, and so on. This variety of resources provide complete information, but teachers should know how to use it to understand a student's performance according to a particular context. The skill of using this data set is the literacy of assessment that teachers need to have. This is important because the use of student data is seen to be very widespread not only to improve the teaching performance of teachers and students' learning in the classroom in particular, but also to inform the stakeholders such as the school administrators, state and national districts, besides contributing to the country's statistical data. Therefore, professional organizations of teachers

and stakeholders should prepare a plan for the preparation of teacher brokers, especially to master the literacy of this data assessment. This article also suggests a panel of experts in providing advice and suggestions related to this data literacy program. This is because, in the current situation today, the accessibility of technology and organisation of data has focused on the more effective use of teachers. Mandinach & Gummer (2016a) have identified five components that include data transfer skills of teachers, namely: (i) Identify problems of practice and frame questions, (ii) Use data, (iii) Convert data to information, (iv) Transform information into a decision, and (v) Evaluate outcomes. In addition, they also recommended the responsibility & cooperation of data usage with the relevant community.

Table 4 : Top five most cited articles in cluster three.

Article	Author/Year	Journal	Total citations	Methodology/Type
What does it mean for teachers to be data literate: Laying out the skills, knowledge, and dispositions	(Mandinach & Gummer, 2016b)	Teaching and Teacher Education	52	Qualitative
Interpretation of the score reports from the Computer Program LOVS by teachers, internal support teachers and principals	(van der Kleij & Eggen, 2013)	Studies in Educational Evaluation	10	Mix Method
Every teacher should succeed with data literacy	(Mandinach & Gummer, 2016a)	Phi Delta Kappan	2	Articel
Misconceptions about data-based decision making in education: An exploration of the literature.	(Mandinach & Schildkamp, 2020)	Studies in Educational Evaluation	2	SLR
Formative assessment: A systematic review of critical teacher prerequisites for classroom practice	(Schildkamp et al., 2020)	International Journal of Educational Research	0	SLR

5.2.2.4 Cluster four: Literacy of assessment and international requirements.

The fourth cluster involves authors focusing on assessment literacy and international requirements(see Table 5).

Teachers should have sufficient level of assessment literacy to applying assessment in an appropriate form. Nevertheless, based on previous literature, the practice of teacher assessment and evaluation were largely inconsistent with the best practices as expected. The findings of Volante & Fazio (2007) included teacher candidates who had a low level of self-

efficacy in teacher assessment literacy. This study targets prospective teachers by completing surveys related to self-explained assessment literacy levels, main purpose of assessment, use of different assessment methods, future training needs and proposed methods to promote assessment literacy in universities and practice teaching settings. This study showed that a significant number of candidates proposed summative purposes for assessment and only a minority stated formative purposes. They love personal observation and communication techniques for a number of identified reasons. This study suggests that the professional development of services is important so that prospective teachers will continue to utilize specific assessment approaches in accordance with the needs and balanced classroom assessment practices.

Assessment capacity and teacher assessment literacy are important for promoting and meeting the learning demands of students (Klenowski, 2011). It is in line with the challenges of a country in its efforts to maintain emphasis on assessment on national test needs factors and international comparative analysis of data on student achievement. In Australia, for example, there are curriculum development, assessment and reporting efforts with the view that teacher assessment can be a valid indicator of outcomes through practise of simplification. This is recognized by The Queensland Studies Authority which support support the implementation of teacher assessment and moderation activities in the framework of national change based on standards. This action is also supported by the latest research which stated that this action can maintain focus on learning while avoiding excessive focus on test results. However, according to Klenowski (2011) such efforts are often challenged by political pressures that tend to carry out national tests by the Australian government and related national partnership financing arrangements especially related to student performance at or below the minimum level.

Willis et al. (2013) mentioned assessment literacy should be put in the discussion of learning theory as ethical, social, dynamic and layered practices. In the context of social practice, assessment literacy depends on the dynamic context. It requires teachers to demonstrate ideas by discussing class and cultural knowledge with students whether at the initial stage, development and practice aimed at achieving student learning goals while supporting one another. This article using Bernstein (1996, 1999) theoretical tools to analysed examples of classroom assessment literacy, classifying and framing as language theory to open the conversation about assessment. The purpose of this conceptualization of assessment literacy is to specifically state some of the essential theoretical frameworks of assessment literacy in order to guide discussion and make policy and practise choices to benefit student learning and achievement.

Table 5 : Top five most cited articles in cluster four.

Article	Author/Year	Journal	Total citations	Methodology/Type
Exploring teacher candidates' assessment literacy: Implications for	(Volante & Fazio, 2007)	Canadian Journal of Education	101	Quantitative

teacher education reform and professional development				
Assessment for learning in the accountability era: Queensland, Australia	(Klenowski, 2011)	Studies in Educational Evaluation	46	General Article
Conceptualising teachers' assessment literacies in an era of curriculum and assessment reform	(Willis et al., 2013)	Australian Educational Researcher	36	Qualitative
Embedding accountability and improvement into large-scale assessment: What difference does it make?	(Earl & Torrance, 2000)	Peabody Journal of Education	24	Quantitative
Assessment of, for, and as Learning within Schools: Implications for Transforming Classroom Practice	(Volante, 2010)	Action in Teacher Education	12	Qualitative

5.2.2.5 Cluster five: Factors influencing teacher assessment.

This fifth cluster involves authors who focus on the factors that influence teacher assessment (see Table 6).

Fulmer et al., (2015) discussed contextual factors such as knowledge, views and concepts that can influence teacher assessment practices. They adapted the model of Kozma (2003) to differentiate these contextual factors in three levels namely micro, meso and macro. The micro-level contains the immediate context of classes, such as a number of influences at the classroom level, the meso-level consists of factors beyond the classroom itself, but with clear influences on the classroom, such as factors usually known as school-level factors and the macro-level consists of distance influences that do not specifically affect the classroom, but may influence the meso-level and thus have indirect impacts on the classroom, such as education policy. The quest in EBSCO, JSTOR and other databases for related articles with an emphasis on complicated relationships within and at this level showed that many researches have been conducted on the micro (teacher) level, such as in values, concepts and knowledge of teachers, while researches at the meso level (school) or connect it to micro- or macro level remain scarce. The results offered hints and advantages for further study of large-scale experiments, such as the simultaneous collection and analysis of all three stages.

According to Deneen & Brown (2016) assessment literacy is considered a significant concept that has expanded to incorporate measurement and assessment with a new viewpoint on learning. They stated that teacher conceptions such as the purpose and role of measurement has an impact on assessment processes and has yet to be discussed in detail.

The results of the analysis include strong affective components and polarized with negative and positive factors appearing to act independently of the level of academic achievement. Academic achievement goes deeper as the articulation role of conception, but does not accompany changes in specific concepts. These findings indicate that during the increase in knowledge of the facts of assessment literacy, the conception of assessment can influence the application of assessment literacy but is not mediated by assessment courses. The results of this study showed a clear disconnection between education, assessment literacy and teacher practice. Therefore, they suggested that the emphasis of the educational on assessment literacy program is necessary by taking into account the concept, the manner in which values are formed and their effect on efficient practice.

The beliefs of students about assessment and technologies play an important role in disseminating technology-based evaluation (Deneen et al., 2018). A global trend is the use of the e-portfolio to establish and measure the achievement of curriculum performance, however little research has been conducted to examine students' technology and assessment perceptions around eportfolio. Validation factor analysis and modeling structure equations determine the relationship between the two conceptual fields and as predictors of the achievement of education. Findings revealed the conceptual relationship between eportfolio as assessment and technology work according to format. In addition to the support and understanding of technology and eportfolio among students, there is also an increase in teachers' confidence in the technological aspect of eportfolio based on a positive attitude that is using or composing format and following their own instructions in order to contribute to something bigger during assessment. Active involvement of the eportfolio and rejecting the assessment as irrelevant, contributed to a moderate level followed by a statistically significant increase in student reports. The study to understand the conceptual convergence between technology and assessment simultaneously in eportfolio is useful to gain insights into the phenomenon of eportfolio as one of the methods of assessment to identify the required changes in the implementation of technology for assessment.

Table 6 : Top five most cited articles in cluster five.

Article	Author/Year	Journal	Total citations	Methodology
Multi-level model of contextual factors and teachers' assessment practices: an integrative review of research	(Fulmer et al., 2015)	Assessment in Education: Principles, Policy and Practice	22	Qualitative
The impact of conceptions of assessment on assessment literacy in a teacher education program	(Deneen & Brown, 2016)	Cogent Education	10	Mix Method
Students' conceptions of eportfolios as assessment and technology	(Deneen et al., 2018)	Innovations in Education and Teaching	9	Quantitative

		International		
Variation in teachers' conceptions of alternative assessment in Singapore primary schools	(Tan, 2013)	Educational Research for Policy and Practice	8	Qualitative
Setting formative assessments in real-world contexts to facilitate self-regulated learning	(Tay, 2015)	Educational Research for Policy and Practice	7	Qualitative

5.2.2.6 Cluster six: *Methods of improving teacher assessment literacy in learning.*

The sixth cluster is the smallest group in the study of assessment literacy. This cluster further discusses methods of improving teacher assessment literacy in learning. Table 7 presents the five authors who belong in this cluster.

Comprehension gained from reading as an exercise can develop listening, speaking, and writing skills for foreign language learners such as English (EFL)(J. M. Chen et al., 2010). The literature review conducted showed that the collaborative learning environment is crucial to improve individual language skills. However, the ability for English language learners to pursue comprehensive reading by cooperation is limited due to resource limitations, lack of precise assessment tools and English teaching personnel rarely assess students with appropriate literacy skills. The use of Tag-based Collaborative Reading Learning (TACO) application that makes use of Web 2.0 Internet social tagging techniques has been proposed by Chen et al. (2010) to provide a collaborative environment to develop the understanding of reading and to support teachers in the correct assessment of literacy. The findings of their post-study assessments showed a substantial improvement in reading scores among tag-based method participants, and teacher survey input showed an increase in literacy evaluation ability as a result of the use of TACO applications.

Teachers need to calculate and report student learning data including formative assessment to fulfil the needs of the use of such data, especially aimed at improving student learning (Cowie & Cooper, 2017). Therefore, teachers need data literacy which is part of assessment literacy. Mathematical and statistical aspects relevant to data literacy need to be mastered by teachers. Despite its importance, previous studies have proven that teachers are still lacking of mathematical and statistical aspects to interpret assessment data. According to Cowie & Cooper (2017), the views of lecturers, student teachers and school leaders on the role, needs of literacy data and how to cultivate mathematical thinking have been considered. Findings showed that both groups of lecturers and student teachers stated that literacy assessment needs to be addressed through technical, contextual and critical dimensions. Principals and representatives in school assessment suggested that novice teachers had the ability and capacity to understand and develop data and assessment capabilities. Therefore, mathematical thinking needs to be identified and applied in courses involving teacher students so that data literacy is clearer. Suggestions through project plans including guidance

and websites to support student self-learning of teachers have been highlighted by the researchers.

The relationship between emotion and achievement needs to be understood. Students' perceptions of the concept of achievement (self-reporting) showed a significant relationship with the emotions of their achievement related to self-learning (J. Chen & Brown, 2018). The study of J. Chen & Brown (2018) proved that significant differences in achievement emotions are due to certain beliefs (development of learning, skills and morals) about assessment. An assessment contributes to developmental beliefs in a way that is believed (assessment conception) by (1) contributing to the moral development and skills of students, (2) being accurate, and (3) not assessing the school or teacher causing these positive emotions to exist. On the other hand, if the focus is only on assessment (conceptual assessment) such as (1) to evaluate schools and teachers and (2) not to enhance teaching and learning or neglect to provide input for development purposes, then negative emotions will exist. To ensure that these positive emotions exist, teachers need to emphasize the formative assessment approach as well as avoid the desire to embarrass or criticise students for not achieving the content. In the effort to do so, many qualitative improvements in teacher assessment literacy are required (J. Chen & Brown, 2018).

Table 7 : Top five most cited articles in cluster six.

Article	Author/Year	Journal	Total citations	Methodology
A novel approach for enhancing student reading comprehension and assisting teacher assessment of literacy	(J. M. Chen et al., 2010)	Computers and Education	30	Mix method
Exploring the challenge of developing student teacher data literacy	(Cowie & Cooper, 2017)	Assessment in Education: Principles, Policy and Practice	13	Mix method
Chinese secondary school students' conceptions of assessment and achievement emotions: endorsed purposes lead to positive and negative feelings	(J. Chen & Brown, 2018)	Asia Pacific Journal of Education	4	Qualitative
Chinese preservice teachers' beliefs about assessment	(J. Chen & Cowie, 2016)	Educational Practice and Theory	3	Quantitative
A study on an automatic early-alert mechanism for a tag-based learning environment: Development	(J. M. Chen et al., 2011)	Proceedings of the 2011 11th IEEE International Conference on	2	Quantitative

of a teaching support platform based on a tag-based knowledge acquisition approach.		Advanced Learning Technologies, ICALT 2011		
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DISCUSSION & CONCLUSION

The findings of the study found that research and publishing enhancements in the subject of assessment literacy began from 1991 until now. This is in line with the statement (Edwards, 2020; Qotboddin Jan-nesar M. et al., 2020) that studies related to assessment literacy are still active till today. The findings also highlighted that researches related to assessment literacy have been widely conducted in the Social Sciences area. This may be due to the fact that this field of knowledge is dedicated to understanding individual interaction in a society and its developments, in line with the topic studied which is assessment literacy. In addition, the Social Science discipline is very broad, covering various subjects such as education, social policy and sociology (Bastow et al., 2014).

The large size of the circle in the mapping shows the frequency of the writing activity measured in terms of publication is high in number (Subramaniam et al., 2020). Figure 4 illustrates analysis of keywords according to fields with minimum number five times co-occurrence in each Scopus documents. There are seven keywords that are often used in the literatures related to assessment literacy, namely students, assessment literacy, feedback, assessment, higher education, formative assessment, teacher education representing 37, 96, 35, 127, 47, 63 and 45 total number of occurrences for each cluster respectively. However, the use of the keyword 'assessment' is most significant and widely used in researches followed by 'literacy assessment' and 'formative assessment' with 227, 161 and 98 total link of strength respectively. The three main circles of these keywords are located in the center of the keywords network and close to each other, indicating that these keywords play a crucial role in writing related to assessment literacy. Similarly, other keywords are all in the same accumulation even though they are in different clusters.

A systematic literature review of co-authorship has obtained a total of six clusters from the collection of a total of 1055 related documents. Cluster 1 has the highest number of writer activities followed by clusters 2, 3, 4, 5 and the lowest is cluster 6. Researches in cluster 1 further discussed the changes in the education assessment system and the confidence of teacher candidates in implementing it. While cluster 6 is the lowest cluster with the least number of reports. Researches in cluster 6 further discussed methods or approaches to improve teacher assessment literacy in learning. This explains that the need to assess student success is one of today's essential duties and is the lifeblood of the teaching and learning process (Jawhar & Subahi, 2020), but still many teachers are not ready (Mertler & Campbell, 2005) and not equipped with adequate skills (Tzu-Hua Wang et al., 2008) to carry out the task. Therefore, it is suggested that future research studies focus on topics related to cluster 6 that are still scarce despite the urgent need to meet the changes in the existing assessment system.

From the analysis, the 6 clusters can further be reduced to 4 main groups which are defined by the relationships between the clusters. The first group consists of clusters 1 and 4 which revolves around changes in the education assessment system, the confidence of prospective teachers in implementing it and the factors that influence teacher assessment. The second group consists of clusters 2 and 5 which revolves around the needs of the concept of assessment and the factors that influence it. Both these clusters have a strong relationship in terms of position in the cluster network (Figure 5). Both groups 1 and 2 are clearly linked by group 4 which consists of cluster 6 only. This group involves the discussion related to methods of improving teacher assessment literacy in learning. Only group 3 consisting of cluster 3 appears to be slightly isolated from the other groups i.e. discussion related to literacy and interpretation of teacher data. However, this group still links with group 1 through the relationship with cluster 4, which is the literacy of assessment and international needs. The relationship between clusters in the network between clusters clearly gives an idea of the writing patterns and research trends of modern researchers.

This systematic literature review also provides an overview of the conventional assessment system seen as no longer relevant to the changing times that have demanded the change of the educational assessment system. This is evidenced by seeing the increasing trend in publication statistics related to assessment literacy as illustrated in Figure 1. These changes in the assessment system demand adequate knowledge (Farhady & Tavassoli, 2018) and the confidence of prospective teachers in implementing it. This knowledge covers the requirements of the concept of assessment that need to be clearly understood and the purpose of the implementation of a policy carried out because it can affect the practice of assessment (Fulmer et al., 2015). Assessment results and data interpretation skills are also part of assessment literacy. In addition, this bibliometric network also shows that assessment literacy is essential to comparing student achievement data within the country and at the international level while discussing the factors that influencing teacher assessment and methods of improving teacher assessment literacy in teaching and learning.

Conclusions can be made by stating that assessment literacy is one of the most important qualifications that every teacher should acquire. In fact, it is not an exaggeration to say that the literacy of assessment is the basis of the teaching profession (Edwards, 2020). It is very important in making a decision (Edwards, 2020) such as choosing assessment methods and developing assessment tasks so that teachers can measure a student's skills and knowledge appropriately. In this context, continuous training is needed so that teachers can enhance the development of their classroom assessment literacy professional practices (Icy Lee, 2017; Jawhar & Subahi, 2020). Comprehensive training can provide an opportunity for the individuals involved to understand the right practices (Bennett & Gitomer, 2009) as well as identifying the challenges and problems of implementing a policy (Yin & Buck, 2019). This is evidenced in a Study by Esfandiari & Nouri (2016) which shows that adequate training can improve the level of assessment literacy.

This bibliographic systematic study provides significant values in systematic mapping and elaboration related to the topic of assessment literacy for future research. Therefore, stakeholders and employers need to focus more on the issues that are often discussed by

researchers related to this field of knowledge. Proposed systematic assessment can be done to identify the level of assessment literacy and the factors that influence it in order to cater the requirements of more focused training. Emphasis should be given to these factors to help support the preservation of assessment education programs in turn allowing teachers to maximize the capability of learning in assessment while observing the achievement of assessed students.

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