**Enhancing the development and understanding of assessment literacy in higher education**

Xiaotong Zhu1,2 and Carol Evans2,3

 *1 University of Lincoln, UK;* *2University of Southampton, UK; 3Cardiff University, UK*

**E-mail address:**

Xiaotong Zhu: xzhu@lincoln.ac.uk

Carol Evans: evansc101@cardiff.ac.uk

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**Biographical Note**

Dr. Xiaotong Zhu is a Research Fellow in the Eleanor Glanville Institute (EGI), the central strategic lead for equality, diversity and inclusion (EDI) at the University of Lincoln. Xiaotong is passionate about improving learning experience of students from diverse backgrounds. Her main research interests include attainment gaps, international education, student engagement, assessment and feedback in higher education, for which she carries out quantitative and mixed methods research studies. Xiaotong also has rich experience of analysing quantitative data using SPSS and conducting meta-analysis using CMA. ORCID: <https://orcid.org/0000-0002-0310-7001>

Professor Carol Evans is National Teaching Fellow and HEA Principal Fellow. She attained a Collaborative Award for Teaching Excellence and Spotlight Award from Advance HE for her work in promoting team-based research-informed assessment design. She has developed higher education assessment policy and practice within and across institutions both in the UK and overseas in numerous capacities such as PVC Learning and Teaching, Griffith University, Professor of Higher Education and Co-Director of the Centre for Higher Education at Southampton University, President of the ELSIN research community. She has led and advised on many cross-institution assessment research projects (e.g., the Office for Students, UK and ERASMUS) to support integrated approaches to assessment utilising the EAT Framework. She is Editor-in Chief of Higher Education Pedagogies Journal and the Higher Education Representative for McGraw Hill. ORCID: <https://orcid.org/0000-0001-9344-8952>

**Abstract**

Enhancing students’ assessment literacy is essential in enabling all students to manage their learning successfully. Understanding of the assessment standards required and how to meet them impacts students’ learning outcomes within higher education (HE). However, there are many different conceptions of what assessment literacy comprises, making it difficult to provide guidance on the most effective approaches to enhancing student and academic understanding of this complex and multifaceted concept. With this concern in mind, we investigated the psychometric properties of an assessment tool and its suitability for use within the context of implementing and evaluating pedagogical interventions aimed at enhancing students’ and academics’ assessment literacy skills. The validity of the tool was confirmed using exploratory and confirmatory factor analyses. Furthermore, the identified relationship between assessment literacy and feedback elements of the tool confirms the importance of an integrated approach to assessment. Drawing on extensive piloting of the tool across disciplines we highlight the importance of pedagogical co-construction approaches that promote shared understandings of assessment literacy between students and academics. Suggestions for further enhancement of this measure are proposed with the aim of supporting academics’ and students’ shared understandings and development of assessment literacy.

KEYWORDS: assessment literacy; factor analysis; higher education; student assessment literacy survey; validity

**Introduction**

Enhancing the effectiveness (i.e. the quality, inclusivity, and efficiency) of assessment in higher education (HE) is a global priority for higher education institutions (HEIs). The importance of assessment literacy cannot be overstated given its potential to impact student achievement. How well students understand the key learning goals and standards required for success is a strong indicator for how well students achieve (Schneider and Preckel 2017). Assessment literacy impacts student engagement with tasks and how they perform. Lack of student understanding of assessment requirements in relation to tasks and learning outcomes act as a significant barrier to learning (Evans et al. 2019). Students with less socio-cultural capital are especially vulnerable in navigating the requirements of assessment (Evans et al. 2021) as they have less access to it. Socio-cultural capital is important in that resources gained by being part of specific social relationships and networks imbues access to the language and ways of working in HE (Fuller, 2014). For example, students who are first in family to attend university will have had less exposure to what the requirements of university will be like. Furthermore, membership of certain social and cultural groups is intrinsically related to educational values of equity and entitlement (Moran, 2009).

In seeking to improve the student learning experience within HE, emphasis has predominantly been placed on enhancing feedback practices with insufficient attention given to the central role of assessment literacy in learning (DeLuca et al. 2019; Price et al. 2012). This oversight is confirmed in our analysis of over 1000 academic peer-reviewed papers from 2012-2018, where we identified that 39% of articles focused centrally on feedback, compared to only 3% with a core focus on assessment literacy within HE (Evans et al. 2019). Of these 3% of articles, most focused on evaluating the impact of interventions implemented (Denton and Mcllroy 2018; Toshizi and Bahraman 2019), or enabling student engagement and voice within the assessment process (Charteris and Thomas 2017; Deeley and Bovill 2017). Furthermore, very little attention has been given to the validity and reliability of assessment literacy instrumentation. Testing pre-established ‘student assessment literacy’ instruments (they are scarce) in different cultural and educational contexts remains an under-explored area of research deserving more attention, in particular in view of the growing interest and realisation of the importance of students’ assessment literacy in HE.

In this paper we explore the potential of Smith et al.’s (2013) *Assessment Literacy Survey* (ALS) to enhance enhance academics’ and students’ understanding and development of assessment literacy within HE. To do this, we explore the reliability and validity of the instrument, and its relevance for use across contexts situated within a research-informed, integrated approach to assessment.

**Assessment literacy within higher education**

Assessment literacy is complex given the variety of constructs involved as described below, and the different conceptual perspectives about the role of students in assessment. The term is used widely and in many different ways; it can be used to describe overarching understandings of assessment requirements For example, knowledge of the assessment process, (Chan and Luo 2021), holistic dimensions of assessment literacy such as one’s role in assessment (Evans 2016), and/or specific disciplinary literacies (knowledge of disciplinary conventions) (Van Heerden, Clarence, and Bharuthram 2017) As a multi-dimensional construct it comprises a range of skills, knowledge, and dispositions (Pastore and Andrade 2019). A myriad of terms describe similar and associated dimensions, for example, academic literacy (HE assessment practices and requirements); epistemological literacy (nature of knowing within a discipline); quality assurance literacy (the rules of assessment within HE including maintenance of standards, appropriateness, and fairness) to name but a few.

Smith et al. (2013) in developing the Assessment Literacy Survey for use in HE identified four factors: (i) *Assessment Understanding* (AU) referring to students’ understanding of the requirements and rules of assessment; (ii) *Assessment for Learning* (AL) referring to students’ understanding of the contribution of assessment to their learning; (iii) *Minimum Effort Orientation* (MEO) referring to students’ dispositions relating to the amount of effort they were willing to apply in completion of a task; and (iv) *Assessment Judgement* (AJ) referring to students’ ability to accurately judge the quality of their work.

The contextual nature of assessment literacy is highlighted in Pastore and Andrade’s (2019, 130) definition of assessment literacy as a situated construct involving ‘a complex interplay of different components interrelated with social, cultural, policy, professional and experiential factors’. In their socio-constructivist model of teacher assessment literacy, Pastore and Andrade identify three inter-related assessment literacy dimensions: (i) a conceptual knowledge dimension (understanding of what assessment is), (ii) a praxeological dimension (assessment in practice and how assessment literacy is used to support learning and teaching processes), and (iii) a socio-emotional dimension (encompassing management of social and emotional aspects of assessment).

Comprehensive interpretations of assessment literacy acknowledge the socio-cultural and political aspects of assessment literacy in how one comes to tacitly know what the requirements of assessment are, what views and practices are privileged, and how to negotiate them as part of a complex assessment feedback landscape (Evans 2013). The importance of context in mediating understanding of assessment literacy and the capacity to develop and enact assessment knowledge and skills is evident in socially constructed interpretations of assessment literacy (Guzmán-Simón and Garcia-Jiménez 2015).

Evans (2016, 2020) highlights the interconnected nature of assessment literacy, assessment feedback and assessment design in her Equity, Agency, Transparency (EAT) integrated model of assessment, arguing that assessment literacy cannot be viewed in isolation. For example, feedback literacy skills are integral to assessment literacy in that students need to understand task requirements and have an understanding of what quality is in order to effectively judge the quality of their own work (Carless and Boud 2019; Tai et al. 2018). Similarly, the uncertainty of how all assessment tasks fit together impacts students’ motivation and decisions around where to focus their efforts (Evans et al, 2019). Lack of understanding of disciplinary assessment literacies (ways of thinking and acting within disciplines) impacts students’ ability to participate in peer support activities (Evans et al. 2017; Van Heerden et al., 2017).

From a cognitive perspective, relating to how an individual makes sense of information, Sadler (2010) highlights the importance of tacit knowledge (Polanyi 1983). Tacit knowledge refers to students’ grasp of task requirements, their understanding of quality in relation to the requirements of the task, and what assessment criteria mean in assisting in the development of quality. Enhancing understanding of the requirements of a task, a key component of assessment literacy, has spawned a considerable body of work focused on cognitive dimensions of assessment literacy that seek to clarify the requirements of assessment by making assessment criteria explicit and transparent (Balloo et al. 2018; Evans, 2016; Van Merrienboer and de Bruin 2019; Waring and Evans 2015). Students need to have an understanding of the purposes of assessment and how these relate to their own goals and learning trajectories if they are to fully capitalise on assessment opportunities (Smith et al. 2013). Students also need a good understanding of assessment processes and the cultures in which they operate in order to manage assessment requirements efficiently (DeLuca et al. 2019).

**Promoting assessment literacy: a student-centred approach**

Despite the considerable body of literature promoting the importance of student agency in supporting the development of assessment literacy (Charteris and Thomas 2017; Evans, 2013, 2022; Price et al. 2012; Tai et al., 2018; Torshizi and Bahraman 2019), a student receipt and response culture to the operationalisation of assessment literacy remains dominant within HE representing a significant research-practice gap. For example, while co-construction and student ownership of the assessment process is promoted in the literature to enable students to understand for themselves (Deeley and Bovill 2017),, emphasis on a ‘telling’ approach’ rather than a student immersion in practice approach is evident (Chan and Luo 2021; Charteris and Thomas 2017; Taras 2015; Torshizi and Bahraman 2019; Wiliam 2014). Assessment rubrics in practice remain mainly constructed *for* students and not *with* them, limiting students’ ability to understand for themselves (Sadler 2013).

There is a substantial evidence base that identifies that the ability of students to be able to judge the quality of their work has considerable impact on learning outcomes, and that this is maximised when students have repeated opportunities to test their understanding through ongoing exposure to self- and peer-assessment opportunities (Smith et al. 2013; Tai et al. 2018). Similarly, acquisition of assessment competence requires students to be able to work with criteria so that they can internalise standards for themselves (Sadler 2010, 2021).

Importantly, it is in the *microstructure of teaching*, precisely how assessment literacy approaches are enacted in practice *with* students that matters (Jankowski 2020; Schneider and Preckel 2017). How educators and students interpret assessment literacy impacts the equity and inclusivity of assessment practices within HE, and warrants far more attention (DeLuca et al. 2019). In supporting students’ assessment literacy, the importance of shared conceptions of quality, shared goals, and shared understandings of the importance of assessment to support learning are fundamental. With this in mind, we adopted an integrated approach to assessment literacy development (ALD) based on the EAT conceptual framework (Evans, 2016, 2020). This framework emphasizes the importance of student engagement and ownership of assessment in the development of high level self-regulatory skills to support the acquisition of assessment literacy.

**Our context for exploring the validity and reliability of the Assessment Literacy Survey**

This study is part of a larger government-funded research project focused on maximising students’ self-regulatory skills through an integrated approach to assessment conducted in three UK universities. The data used in this paper comes from one of these three institutions: a Russell Group University involving 1313 students in 21 pedagogical projects aimed at enhancing students’ engagement in in assessment literacy, assessment feedback, and assessment design (Evans et al. 2019).

 The focus of the pedagogical interventions was on developing shared conceptions of academic quality between academics and students in order to promote students’ self-regulatory skills, and especially their assessment literacy skills as a key part of this. Self regulation in an assessment context focused on students being able to accurately interpret the requirements of tasks, select appropriate strategies to realise goals, and monitor and evaluate their performance in relation to such goals.

To support students’ assessment literacy and ensure fidelity to principles of effective assessment feedback derived from Evans’ (2013) definitive work on assessment feedback in HE. Principles based on her systematic review of the literature and subsequently developed with student and staff teams at the university to become integral to policy. This included ongoing sharing and dissemination of resources and findings at discipline and institution levels to evolve practice. Importantly, each project was attuned to disciplinary and programme priorities while remaining aligned to key principles of effective assessment practice. The projects actively engaged students in: (i) developing assessment criteria with academics, (ii) mapping out the links between assessments within and across courses, (iii) marking and moderating work, (iv) giving feedback to others to support their own understanding of quality, and in (v) mapping key concepts, and exploring the nature of knowing within disciplines (*what it is to be*, and what it *looks like to perform well* within a discipline). To evaluate the effectiveness of the initiatives, a range of measures was used, many as pre- and post-test measures as part of one to three year longitudinal assessment literacy projects.

 The Assessment Literacy Survey (ALS) (Smith et al., 2013) was selected as a potential tool to evaluate students’ development of assessment literacy given that it was developed for a similar purpose, to evaluate the impact of assessment literacy building pedagogical interventions on students’ assessment literacy and outcomes. Smith et al.’s (2013) ALS was developed for use within the Australian HE context and involved Business Studies students. The ALS comprises 4 factors derived from 17 questionnaire items rated on a 5 point likert scale. In this paper we report on the validation of the ALS with a sample of UK undergraduate students enrolled in a wide range of disciplines. The relationship between the different factors comprising the ALS, and the relationship between students’ conceptions of assessment literacy and assessment outcomes are explored.

***Participants***

The factor structure of the ALS was tested using a convenience sample of 755 undergraduate students (51.3% female, 48.5% male and 0.2% other gender category). Participants comprised first year students from two consecutive year groups (2017-2018 and 2018-2019). The students were enrolled in various degree courses across six disciplines (Biological Sciences, Business, Film, History, Law and Ocean and Earth Science). Ranging in age from 17 to 40 years (*M*=19.17, *SD* = 2.65), slightly over half (52.7%) were the first person in their immediate family to study at a university. In seeking to avoid the risk of overfitting (Fokkam and Greiff, 2017) and given data were entered into SPSS randomly, this sample was further split into two halves. Data with even row numbers in SPSS (n=377) were used to perform exploratory factor analysis (EFA) and were referred to as sample one in this paper. Sample two used for confirmatory factor analysis (CFA) contained data with odd row numbers in SPSS (n=378).

***Procedure and data processing***

The twenty-minute survey (paper or electronic) was distributed among full-time, campus-based students. Ethical approval was obtained from the university’s ethics committee, following its institutional ethics policy and general data protection regulations. This paper drew on demographic information and the ALS data which were processed and analysed using SPSS 25 for descriptive statistics and EFA and AMOS 25 for CFA. CFA was carried out on a random half-sample of the participants (i.e. sample two). Listwise deletion was used for handling missing data to prevent overestimation (Tabachnick and Fidell 2007).

***Data analyses***

For the EFA phase principal component analysis (PCA) was conducted to establish the factor structure of the ALS on a UK sample (Field 2009; Pett, Lackey, and Sullivan 2003). The decision as to how many components (i.e. factors) to be extracted was not pre-determined and was subject to sampling adequacy for analysis using a number of measures: Kaiser-Meyer-Olkin measure (value above the acceptable limit of .50); intercorrelations between questionnaire items (Bartlett’s test of sphericity *p* < .05); diagonals of anti-image correlation matrix (above .50); the scree plot together with eigenvalues (over Kaiser’s criterion of 1), and communalities (greater than .30).

Theoretical considerations about the complex nature of the assessment literacy construct and inter-correlations among the four assessment literacy factors of the ALS as identified by Smith et al. (2013) resulted in the selection of oblique rotation. The criterion value of .35 or greater was used in terms of assessing individual scale item’s factor loading onto exacted factors. Further elimination was applied if an individual item loaded simultaneously on two extracted factors without a difference of .30 or above between loadings on the primary and the other factors. Internal reliability was examined through Cronbach’s Alpha (α), with values above .60 considered acceptable and .80 or greater good (Taber 2018; Tavakol and Dennick 2011). If an item had a low correlation with the overall questionnaire scores (item-total correlation below .30), it was also noted for potential deletion.

To further validate the ALS, the factor structure derived from the EFA was subsequently cross-validated in CFA on sample two (Hu and Bentler 1995; van Pooijen and van der Kloot, 2001). The goodness of fit was evaluated through chi-square (χ2) values, Tucker-Lewis Index (TLI) and the comparative fit index (CFI), with non-significant χ2, TLI and CFI over .90 regarded as indicative of acceptable model fit (Whittaker 2016). According to Kline (2005), chi-square values are highly dependent on sample size so normed chi-square (NC; i.e. χ2/*df)* was also considered with values below 2.0 deemed a close model fit to the sample data (Cole 1987). The root mean-square error of approximation (RMSEA) and its 90% confidence intervals were evaluated (values less than .05 reflecting close model fit and up to .08 indicating acceptable fit between the model and the sample data) (Hu and Bentler 1995). The PCLOSE test provided another approach to evaluating fit of the model, with a value greater than .05 reflecting close model fit (Kline 2016).

Construct validity was further assessed following Hair et al. (2010) and Schreiber et al. (2006). The fit of a single-factor assessment literacy model was compared with that of a four-factor model; a better fit of the latter model would be indicative of discriminant validity. The nature of correlations between the four assessment literacy factors was also considered; a finding of small correlations among factors would support discriminant validity. To assess convergent validity the statistical significance of all factor loadings was examined (Hair et al. 2010).

**Results**

***Exploratory factor analysis: Exemplification of process and results***

PCA (with oblique rotation) was conducted on the 17-item ALS which was fully completed by 323 participants in sample one. This provided a ratio of 19 participants per questionnaire item which was smaller than the recommended ratio of 30 participants per item to make factors stable (Yong and Pearce 2013). The KMO index of .75 verified the sampling adequacy for the analysis. At the data screening stage, no item was noted for elimination after examining the correlation matrix for all items (Field 2009). Bartlett’s test of sphericity was significant (χ2 (136) = 1618.55, *p*< .001), indicating that intercorrelations among the ALS items were well defined for a PCA. In agreement with Smith et al., four factors were identified based on eigenvalues over 1. This was also confirmed after closer inspection of the scree plot. Therefore, four factors were retained.

The four component/factor solution with all 17 items (see Table 1) explained 55.63% of the variance: factor 1 (23.42%), factor 2 (13.05%), factor 3 (10.34%) and factor 4 (8.83%). Examination of the pattern of loadings shows that items clustering on the same factors or components were similar to the item pattern reported by Smith et al. (2013). Therefore, the four factors extracted were confirmed as: assessment understanding (AU) for factor 1 containing 6 items, assessment for learning (AL) for factor 2 containing 5 items, minimum effort orientation (MEO) for factor 3 containing 3 items, and assessment judgement (AJ) for factor 4 containing 3 items. Diagonals of the anti-image correlation matrix were .59 or greater for all items. Communalities after extraction ranged from .38 to .81 and had an average of .56.

While MEO had an acceptable albeit relatively low reliability (*α* = .69), AU, AL, and AJ had high reliabilities (*α*s = .82, .85, and .80 respectively). Table 2 illustrates the corrected item-total correlations, where all values were above .30 thus supporting good correlations between each item and the overall scale score.

**[Insert Tables 1 and 2 as close to here as possible.]**

Correlations among the four rotated ALS factors were also compared. As shown in Table 3, the highest association was between factor 1 assessment understanding and factor 4 assessment judgement, *r*= .31; a pattern found in Smith et al.’s original findings. Minimum effort orientation (factor 3) negatively correlated with assessment for learning (factor 2), *r*= -.11, which was also congruent with Smith et al.’s previous findings. The factor inter-correlations were small with all absolute values up to .31. This indicates that the four ALS identified factors shared little variation between them and were largely independent of each other.

**[Insert Table 3 as close to here as possible.]**

***Results for confirmatory factor analysis: Exemplification of process and model fit***

CFA was conducted to verify the four-factor assessment literacy model obtained from the EFA using sample two with 330 participants after addressing missing data. Univariate normality of ALS subscale scores was examined by means of skewness and kurtosis statistics and histograms. As shown in Table 4, skewness and kurtosis values suggested a non-substantial violation of univariate normality but this was within an acceptable range (i.e. between -1.96 and +1.96) (George and Mallery 2010; Kim 2013). The mean of subscale scores ranged from 2.26 for MEO to 3.91 for AL. Significant and positive correlations were found between AU and AJ scores (*rs* = .45, *p* < .01) and between AL and AJ scores (*r*s = .12, *p* < .05). MEO scores were significantly inversely correlated with AL scores (*rs*= -.23, *p* < .01) and AJ scores (*r*=-.12, *p*<.05). Again, these correlations were in the same direction as those reported in Smith et al. The correlations between the items and standard deviations are presented in Appendix A.

Based on the correlations presented in Table 4, we hypothesised correlations between two pairs of factors, that is, a negative correlation between MEO and AL (i.e. those prepared to apply more effort to their studies were more likely to have positive conceptions of the value of assessment in supporting learning), and a positive correlation between AU and AJ (i.e. students perceptions of their understanding of assessment requirements would lead them to feel more confident in their ability to accurately judge the quality of their work).

**[Insert Table 4 as close to here as possible.]**

The hypothesised model (i.e. the four-factor, 17-item model obtained from the results of preliminary EFA) as presented in Figure 1, was tested by CFA with Maximum Likelihood (ML) estimation. Results in Table 5 indicated that the fit of this hypothesised model (Figure 1) was not adequate (χ*2* = 299.950, *p* < .001, *df* =117, TLI = .855, CFI = .875, RMSEA = .069 with 90% CI ranging from .059 to .079, p-close < .01). Modification indices recommended that the biggest fit improvement was allowing error covariances between two different pairs of variables, of which all were within the AU factor: with pair one represented by AU1 (“*I understand the rules applying to assessment”)* and AU2 (*“The department's assessment procedures are clear to me*”); and pair two including AU5 (*“I understand what I need to do to advance my learning to achieve the standard I want*”) and AU6 (“*I understand what I need to do in the assessment tasks to get the mark or grade I want*”). After closer inspection, the similar item content and wording shared by each pair of these AU indicators were noted and provided a pragmatic justification to modify the hypothesised model by allowing the two error covariances to be freely estimated (Cabrera-Nguyen 2010).

 **[Insert Figure 1 and Table 5 and as close to here as possible.]**

We re-specified the four-factor hypothesised model through adding the two pairs of correlated errors as described above and conducted a further CFA (see Table 5). Fit indices of the re-specified model significantly improved in relation to the original hypothesised model containing no correlated errors (χ2D(2) = 86.368, *p* < .05). Results yielded an inferential test of χ2 = 213.582 (*p*< .001, *df* =115), with a NC value of 1.857 indicating close fit. Both TLI and CFI values were greater than the conventional thresholds for an acceptable model fit (TLI = .921; CFI = .933). The RMSEA and PCLOSE test results also confirmed an acceptable model fit for the tested model (RMSEA = .051 which fell between .040 and .062; p-close = .422) resulting in us retaining this re-specified four-factor model containing two error covariances (Figure 2).

**[Insert Figure 2 as close to here as possible.]**

Based on the understanding that ‘when the amount of missing data are large (greater than 10%) the results of subsequent statistical analyses may be biased’ (Bennett 2001, 464), missing data in sample two was used to re-test the retained model (Figure 2) using full information maximum likelihood (FIML) for comparison purposes. No substantial differences could be identified in the indices in relation to those reported above (χ2 = 213.503, *p*< .001, *df* = 112; NC= 1.906; TLI = .911; CFI= .935; RMESA = .049 which fell between .039 and .059; p-close = .550).

In addition to examining the overall model fit of the retained model, the CFA also tested a one-factor model for comparative purpose to establish discriminant validity (Hair et al. 2010; Kline 2016). Fit indices of this model (presented in Table 5), suggest that this one-factor model had a poor model fit.

Standardised factor loadings of all the ALS items (Figure 2) were checked to assess convergent validity and found to be statistically significant (*p* < .05). However, the size of standardised factor loadings supported convergent validity with varied levels of strength. For example, factor loadings on the AJ factor were strong ranging from .51 to .91. But the range of factor loadings on the AL factor was .45 to .53 indicating doubtful convergent validity (i.e. degree to which two variables that should be related, are related). The estimated correlations between factors MEO and AL and between AU and AJ were small to moderate (-.31 and .42 respectively), providing evidence for discriminant validity (i.e., that variables that are not supposed to be related, are in fact unrelated) (Kline 2016).

**The reliability and validity of the Assessment Literacy Survey**

Our findings support the validity of the ALS in measuring students’ assessment literacy across disciplines. The EFA performed on half of the sample (sample one), resulted in a four-factor model (Figure 1) where the number of factors and item loading patterns confirmed Smith et al.’s (2013) original findings.Reliability analysis indicated high to acceptable internal consistency for each factor retained (assessment for learning α=.85; assessment understanding α=.82; assessment judgement α=.80; minimum effort orientation α=.69). Directions of correlations amongst the four factors were consistent with Smith et al.’s findings. For example, minimum orientation effort was negatively correlated with assessment for learning whilst assessment understanding was positively correlated with assessment judgement. All these correlations were either weak or moderate, suggesting a good level of discriminant validity. The subsequent CFA was conducted on a separate, second half sample (sample two), with model modification carried out in a post hoc manner. The CFA results showed that the modified model (Figure 2) containing two pairs of correlated measurement errors within the assessment understanding factor, provided better fit than the model obtained from the EFA. Similar wordings and meanings of those items provided pragmatic justification for the error correlations added (Cabrera-Nguyen 2010). A third model – the one-factor model – was also tested, but, again, had a poorer model fit than the modified model as presented in Figure 2. This added support for discriminant validity.

Caution is needed in the interpretation of results. There might be other explanations for the correlated errors within the assessment understanding factor in the modified model, such as the possibility that there exists an unknown extraneous variable that potentially affects students’ assessment literacy (Landis, Edwards, and Cortina 2009). There is a paucity of studies reviewing the practice of allowing error correlation, and findings from those studies available remain inconclusive making the issue more complicated (e.g. Cole, Ciesla, and Steiger 2007; Hermida 2015). Apart from modification indices, we allowed the errors to correlate within the assessment understanding factor because of the highly similar wordings and meanings the two pairs of items in question appeared to share.

**The utility of the Assessment Literacy Survey**

In focusing on the technical aspects of assessment literacy, the ALS provided a useful entry point to explore students’ conceptions of assessment literacy. As suggested by Smith et al., the ALS can be used to gauge a specific dimension of assessment literacy (e.g. students’ understanding of assessment criteria), and to examine how the four factors differentially affect students’ assessment marks and other educational outcomes.

In using the ALS as a pre and post-test measure we were able to identify areas of assessment literacy that students felt less confident in and were able to target training accordingly. For example, Table 4 shows that students’ confidence in their assessment judgement was relatively low in our sample (*M*=2.97, *SD* = 0.79) suggesting pedagogic effort is needed to support them in developing their ability to accurately judge the quality of their own and others’ work; a key priority for HE institutions globally given the importance of this factor in impacting student learning outcomes.

 Like Smith et al. (2013) we found minimum effort orientation (MEO) was associated with weaker student performance. However, within the MEO group we identified high self-regulatory students who had chosen deliberately in which courses they would apply effort in order to achieve desired outcomes. They had made a conscious decision to drop marks in modules that *‘they were just not into and/or could not see the relevance to future work’*. This discriminatory approach to effort expenditure could be viewed in different ways. While these highly sophisticated ultra-autodictats are successful in managing individual workload and priorities to achieve desired results, their relative lack of engagement with a specific course may have negative effects for others (i.e. lack of collaborative working). This finding also highlights the importance of attending to goals as a key element of assessment literacy if students are to develop the required deep approaches to learning in order to understand for themselves.

The effectiveness of the assessment literacy pedagogical interventions was demonstrated in students’ enhanced perceptions of their ability to make accurate judgements about their own and their peers’ work (AJ). Perceptions of assessment judgement were associated with better assessment understanding (AU) (*r*=.44, *p*<.01), and higher levels of self-regulation (*r*=.22, *p*<.05). Decreased minimum effort orientation (MEO) was associated with more positive attitudes towards feedback (general feedback orientation) (*r*= -.16, *p*<.05) and better assessment understanding (AU) (*r*=-.13, *p*<.05).

As previously noted, assessment literacy is context dependent. In our pedagogical intervention models we focused explicitly on developing shared understandings of assessment literacy between students and academics by engaging students centrally in practice using an integrated assessment framework; this is unique within the sector.

**Lessons learned for improving assessment literacy in higher education**

 Using the ALS and a range of other measures to support triangulation of findings, effective elements of assessment literacy training were identified. Firstly, processes and tools to support the development of assessment literacy need to be embedded within the delivery of the curriculum and not be extraneous to it. These tools need to demonstrate reliability and validity and be sensitive to specific disciplinary needs. Training and tools need to accommodate entry level users and those experienced in assessment pedagogies (Kelly 2004).

Secondly, we found highly variable conceptions of assessment literacy among both academics and students, with many students remaining confused about what assessment required from them, even at the end of their first year of university study (Evans et al. 2019). People make sense of language and artefacts such as assessment policy and processes in very different ways and ensuring quality in such artefacts (e.g. assessment criteria, rubrics), and shared understandings of good practice is imperative. Much more attention should be placed on clarifying the requirements of assessment and this needs to happen through engaging students centrally in the design of assessment.

Thirdly, the scale of enquiry needs consideration. Aggregating data at university level provided a much needed overview of attainment for different groups of students but it also masked the changes that were occurring at the micro (course) level. It is at this micro level that the impact of assessment interventions can most easily be observed. Interventions designed to support students’ development of assessment literacy impacted groups of students differently, revealing the impact of individual difference variables (e.g. first in family to go to university, gender, socio-economic class, ethnicity etc.). Students’ conceptions of their assessment literacy demonstrated both consistency and variation across groups requiring in-depth qualitative analysis as to the reasons underpinning the trends. Ongoing monitoring and evaluation of students’ conceptions of assessment is important to address any unwanted consequences of assessment interventions on student dispositions and attainment.

**Future Directions**

In advancing understandings of assessment literacy attention should be directed towards those high leverage activities that best promote academic and student success in teaching and learning (Grainger et al. 2017). Utilising evidence on high level self-regulatory dispositions (Dinsmore 2017), deep learning attributes (McCune and Entwistle 2011), agentic engagement (Reeve 2013) and social, political and ethical considerations (Pastor and Andrade 2019) provides a useful way forward. Greater emphasis needs to be placed on the central role of goal-setting within assessment literacy (what a student is trying to achieve and how they can get there) (Sadler 2021), and achieving congruence between academic and student goals as part of this.

 An integrated approach to assessment literacy skill development is important, given that assessment literacy is essential in supporting students’ self-evaluative capacity and independence in learning. Engagement is critical in that students need to be able to observe quality in its many different manifestations and have opportunities to emulate, practice and evolve ideas in the pursuit and development of quality for themselves (Zimmerman 2000).

The ALS survey is an efficient and useful tool to support understanding of assessment literacy for students and academics. There is, however, much potential to develop an integrated assessment literacy measure that can be fine-tuned for students and academics alike. In working towards a more integrated model through synthesizing findings from multiple university-wide projects, the following areas, in relation to the four ALS factors that we have validated, warrant further attention:

Assessment Understanding

* *Political literacy* - understanding of the culture(s) underpinning assessment practices; the written and unwritten rules (Evans et al. 2019).
* *Filtering ability* – the ability to accurately process and make sense of information including the ability to accurately decipher disciplinary/professional codes (Waring and Evans 2015).
* *Socio-emotional confidence* – in engaging with others, being receptive to feedback, and willing to challenge ideas (relational skills) (McCune and Enwistle 2011)
* *Networking capacity* – the ability to develop appropriate networks to support understanding and to take one to the next level as part of a co-regulatory approach (Schoor, Narciss, and Körndle 2015).

Assessment for Learning

* *Big picture thinking* – being able to identify how assessment elements fit together and their relevance to the bigger picture (Blasco, 2015; Kozhevnikov et al. 2014)
* *Metacognitive flexibility* – the ability to adapt strategy to suit differing assessment demands. This includes the ability to *manage and integrate multiple assessment literacies* across courses, and to see connections across modules/courses and programmes (Nguyen et al. 2014).
* *Data literacy* - ability to use data effectively to support learning (Ifenthaler 2017).

Minimum Effort Orientation

* *Assessment identity(*ies) – seeing oneself as an active and agentic partner in influencing the assessment process (Reeve 2013; Waring and Evans 2015)
* *Quality and discernment of metacognitive strategy use –* deploying the right strategies well (Dinsmore 2017)
* G*rade goal clarity* – clear about the minimum standards one would be content with and how to achieve them (Schneider and Preckel 2017)

Assessment Judgement

* + - *Holistic ability and judgement –* the ability to make holistic judgements about the quality of work through attending to multiple criteria, and seeing the depth and surface features of a piece of work while you are doing it (Sadler 2010, 2021).
		- *Cue consciousness* – accurate and discerning use of cues to support learning (Yang and Carless 2013).
		- *Control* – knowing what to change and when to make changes (Sadler 2021)

In sum, to enhance HE assessment literacy practices, the integrity of the assessment process including informed and judicious use of frameworks and tools is paramount. Students need to be fully engaged in the how and why of assessment design if they are to understand assessment processes and the impacts of their assessment decisions on learning. This requires questioning the traditional roles attributed to students and academics and evaluating the student-educator team role in the assessment process (Guzman-Simon and Garcia-Jimenez 2015). Wiliam (2014) argues that by making the theoretical groundings of an approach clear, and making explicit the surface (design) features that can make it happen, it is possible to change conceptions and practice. Informed use of measures such as the ALS, as part of an integrated approach to assessment, is essential in this regard.

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| **Table 1. Summary of Exploratory Factor Analysis Results for ALS (*N(listwise)* = 323)** |
|  **Rotated Factor Loadings** |
| **Item** | **Factor 1****(AU)** | **Factor 2****(AL)** | **Factor 3****(MEO)** | **Factor 4****(AJ)** |
| I understand the achievement standards against which my work will be assessed (au4) | .80 |  |  |  |
| I understand the criteria against which my work will be assessed (au3) | .79 |  |  |  |
| The Department's assessment procedures are clear to me (au2) | .78 |  |  |  |
| I understand the rules applying to assessment (au1) | .63 |  |  |  |
| I understand what I need to do in the assessment tasks to get the mark or grade I want (au6) | .57  |  |  |  |
| I understand what I need to do to advance my learning to achieve the standard I want (au5) | .56 |  |  |  |
| I use assessment to show me how much of the course content I understand (al3) |  | .67 |  |  |
| I learn more when I do the assessment tasks (al2) |  | .66 |  |  |
| I use assessment to figure out what is important to learn (al1) |  | .65 |  |  |
| I use assessment to work out what are the expected achievement standards (al4) |  | .63 |  |  |
| I use assessment to work out how well I am doing (al5) |  | .60 |  |  |
| My aim is to pass the course with as little work as possible (meo1) |  |  | .84 |  |
| I use assessment to work out the minimum work needed to pass (meo3) |  |  | .79 |  |
| I do assessment because I have to (meo2) |  |  | .72 |  |
| I feel confident I could judge my own work accurately using my knowledge of the criteria and achievement standards provided (aj1) |  |  |  | .91 |
| I feel confident I could judge my peer's work accurately using my knowledge of the criteria and achievement standards provided (aj2) |  |  |  | .90 |
| I feel confident I use the criteria and achievement standard guidelines provided in order to help me improve my work (aj3)  |  |  |  | .54 |
| % of variance explained | 23.42 | 13.05 | 10.34 | 8.83 |
| Internal reliability (Cronbach’s α) | .82 | .85 | .69 | .80 |
| Note. Item loadings < .35 have been suppressed; ALS = Assessment Literacy Survey (Smith et al. 2013); AU = assessment understanding; AL = assessment for learning; MEO = minimum effort orientation; AJ = assessment judgement. |

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| **Table 2. Summary of Corrected Item-total Correlation Statistics for Four ALS Subscales** |
| **Item** | **Factor 1****(AU)** | **Factor 2****(AL)** | **Factor 3****(MEO)** | **Factor 4****(AJ)** |
| au4 | .66 |  |  |  |
| au3 | .66 |  |  |  |
| au2 | .58 |  |  |  |
| au6 | .59 |  |  |  |
| au1 | .43 |  |  |  |
| au5 | .56 |  |  |  |
| al2 |  | .40 |  |  |
| al3 |  | .41 |  |  |
| al1 |  | .39 |  |  |
| al4 |  | .40 |  |  |
| al5 |  | .38 |  |  |
| meo1 |  |  | .55 |  |
|  meo3 |  |  | .52 |  |
| meo2 |  |  | .47 |  |
| aj1 |  |  |  | .72 |
| aj2 |  |  |  | .73 |
| aj3 |  |  |  | .48 |
| Note. ALS = Assessment Literacy Survey (Smith et al. 2013); AU = assessment understanding; AL = assessment for learning; MEO = minimum effort orientation; AJ = assessment judgement. |

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| **Table 3. Factor Correlation Matrix** |
| **Factor** | 1 (AU) | 2 (AL) | 3 (MEO) | 4 (AJ) |
| 1 (AU) | - | .05 | -.05 | .31 |
| 2 (AL) |  | - | -.11 | .04 |
| 3 (MEO) |  |  | - | -.01 |
| 4 (AJ) |  |  |  | - |

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| **Table 4. Summary of Descriptive Statistics and Spearman’s Correlation for Four ALS Subscales (*N(listwise)* = 330)** |
|  | **No. of items** | ***M*** | ***SD*** | **Range** | **Skewness** | **Kurtosis** | **AU** | **AL** | **MEO** | **AJ** |
| **AU** | 6 | 3.50 | 0.62 | 1.33 – 4.83 | -0.70 | 0.42 | - | .07 | -.07 | .45\*\* |
| **AL** | 5 | 3.91 | 0.49 | 2.20 - 5.00 | -0.07 | 0.06 |  | - | -.23\*\* | .12\* |
| **MEO** | 3 | 2.26 | 0.77 | 1.00 – 5.00 | 0.43 | 0.02 |  |  | - | -.12\* |
| **AJ** | 3 | 2.97 | 0.79 | 1.00 – 4.67 | -0.26 | -0.21 |  |  |  | - |
| Note. ALS = Assessment Literacy Survey (Smith et al. 2013); AU = assessment understanding; AL = assessment for learning; MEO = minimum effort orientation; AJ = assessment judgement; *M* and *SD* represent subscale mean and standard deviation; \* *p* <. 05; \*\* *p* < .001, two-tailed. |

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| **Table 5. Fit Indices of Assessment Literacy Scale (ALS) Models Tested in Confirmatory Factor Analysis (*N* = 330)** |
| **Model tested** | ***χ2*** | ***df*** | ***NC*** | ***p*** | **TLI** | **CFI** | **RMSEA****(90% CI)** | **p-close** |
| Single-factor model | 824.976 | 119 | 6.932 | <.001 | .451 | .520 | .134(.126 - .143) | <.01 |
| Hypothesised four-factor model (Figure 1) | 299.950 | 117 | 2.564 | <.001 | .855 | .875 | .069(.059 - .079) | <.01 |
| Modified model allowing two error covariances (Figure 2) | 213.582 | 115 | 1.857 | <.001 | .921 | .933 | .051(.040 - .062) | .422 |

1

e

au1

1

1

e

e

e

e

au4

au5

au3

au2

1

1

1

1

e

au6

1

e

al1

1

1

e

al2

1

e

al3

1

e

al4

1

e

al5

1

1

e

meo1

*.20*

1

aj2

aj1

meo3

meo2

e

e

e

3

13

1

1

1

1

e

1

e

aj3

Figure 1. The Hypothesised Model of Assessment Literacy Survey Obtained from Exploratory Factor Analysis Results

e

au1

.38

.43

.63

e

e

e

e

au4

au5

au3

au2

.83

.78

.51

.63

.33

e

au6

e

al1

.53

e

al2

.51

.42

.50

e

al3

.45

e

al4

.52

-.31

e

al5

.71

e

meo1

*.20*

.58

aj2

aj1

meo3

meo2

e

e

e

3

13

.69

.80

.91

e

.51

e

aj3

Figure 2. Confirmatory Factor Analysis Path Diagram with Standardised Estimates: Four-factor Solution Model with Error Covariances for Assessment Literacy Survey (*N* = 330; χ2 =213.582, df = 115; NC = 1.857; TLI =.921; CFI =.933; RMSEA =.051; p-close=.422; e= error; *p* <.05 for all estimates.)

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| **Appendix A:** **Correlations and Standard Deviations for Confirmatory Factor Analysis (*N(listwise)* = 330)** |  |
| **Observed variable** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** |
| Assessment Understanding (AU) |  |
| 1. au1 | - | .55 | .32 | .26 | .21 | .26 | -.01 | -.02 | .06 | .02 | .08 | -.09 | -.10 | -.08 | .13 | .21 | .23 |
| 2. au2 |  | - | .53 | .45 | .36 | .42 | .07 | .04 | .09 | .004 | -.02 | -.08 | -.07 | -.06 | .18 | .25 | .32 |
| 3. au3 |  |  | - | .67 | .39 | .48 | .04 | .02 | .02 | .07 | .06 | -.05 | -.03 | -.08 | .23 | .32 | .40 |
| 4. au4 |  |  |  | - | .41 | .52 | -.002 | -.01 | -.02 | .04 | .004 | -.01 | .02 | -.03 | .16 | .20 | .29 |
| 5. au5 |  |  |  |  | - | .54 | .04 | .09 | .01 | -.02 | .06 | -.04 | -.05 | -.004 | .27 | .28 | .37 |
| 6. au6 |  |  |  |  |  | - | .06 | .06 | -.02 | .05 | .10 | -.03 | -.008 | .03 | .30 | .29 | .40 |
| Assessment for Learning (AL) |  |
| 7. al1 |  |  |  |  |  |  | - | .33 | .26 | .23 | .26 | -.03 | -.14 | -.02 | .05 | .06 | .05 |
| 8. al2 |  |  |  |  |  |  |  | - | .30 | .17 | .21 | -.09 | -.19 | -.08 | .09 | .05 | .17 |
| 9. al3 |  |  |  |  |  |  |  |  | - | .18 | .25 | -.008 | -.19 | -.13 | .04 | .04 | .09 |
| 10. al4 |  |  |  |  |  |  |  |  |  | - | .31 | -.15 | -.12 | -.13 | -.06 | -.06 | .16 |
| 11. al5 |  |  |  |  |  |  |  |  |  |  | - | -.19 | -.08 | -.14 | .06 | .007 | .17 |
| Minimum Effort Orientation (MEO) |  |
| 12. meo1 |  |  |  |  |  |  |  |  |  |  |  | - | .41 | .50 | -.10 | -.05 | -.19 |
| 13. meo2 |  |  |  |  |  |  |  |  |  |  |  |  | - | .39 | -.08 | -.12 | -.10 |
| 14. meo3 |  |  |  |  |  |  |  |  |  |  |  |  |  | - | -.004 | .03 | -.10 |
| Assessment Judgement (AJ) |  |
| 15. aj1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | - | .73 | .39 |
| 16. aj2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | - | .45 |
| 17. aj3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | - |
| *SD* | .73 | .88 | .96 | .87 | .82 | .87 | .83 | .84 | .81 | .75 | .65 | .86 | 1.13 | .95 | 1.00 | .92 | .91 |