



Transforming Access
and Student Outcomes
in Higher Education

TASO Access and Success Questionnaire (ASQ)

Technical report of the
validation process for the ASQ

February 2024

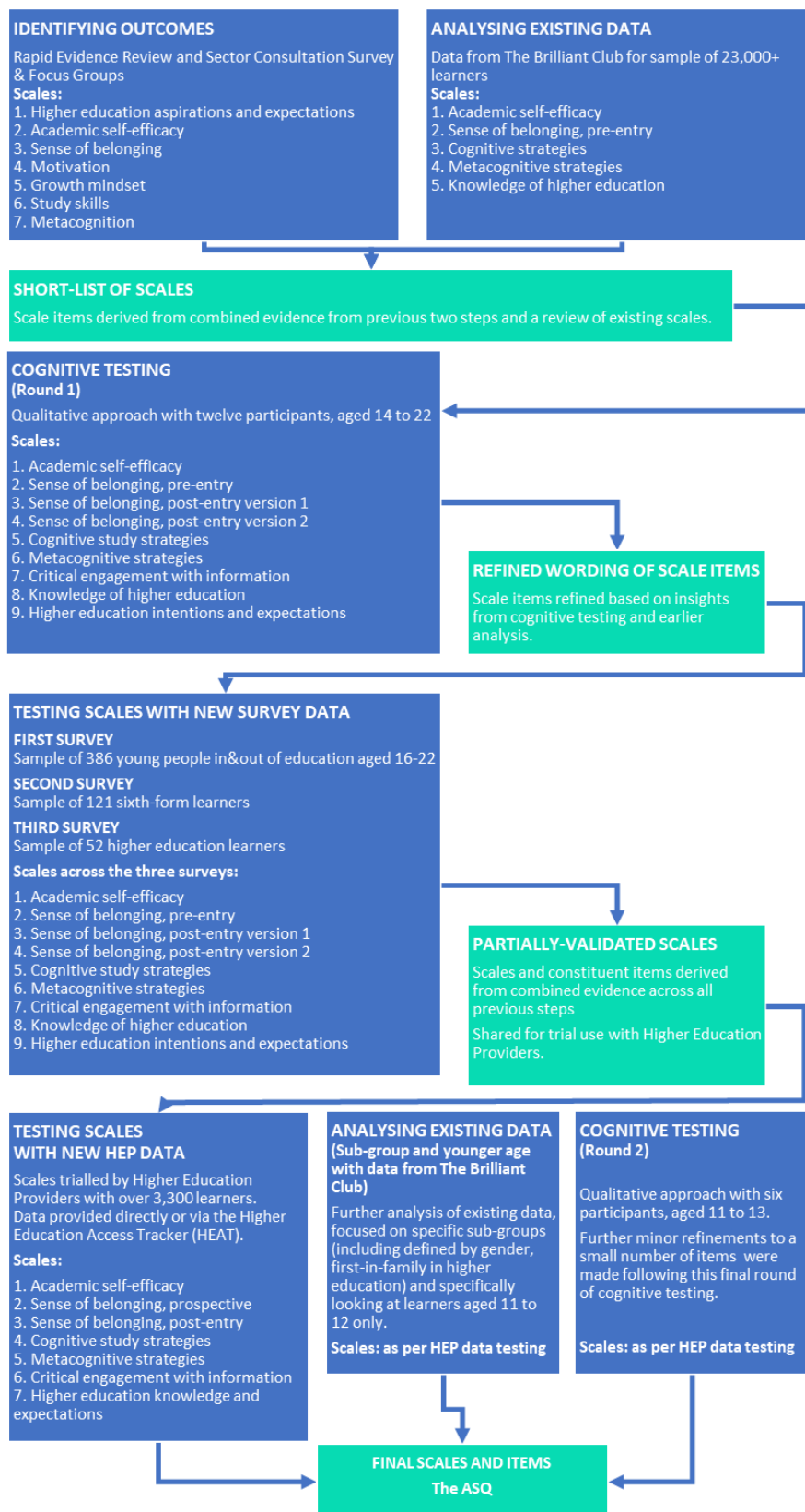
The validation process for the ASQ

OVERVIEW

Scale validation is a complex, multi-step process that aims to develop scales that are valid (they measure what they set out to measure), reliable (they measure consistently), and appropriate for the respondents who will most likely engage with the scales.

The validation process for the Access and Success Questionnaire (ASQ) scales took many steps. These are outlined in this document, together with technical details surrounding the cognitive testing, surveys, and statistical analysis of data emerging from the surveys and the deployment of the scales by collaborating higher education providers (HEP) between November 2022 and May 2023. Together, these pieces of evidence were all used to develop the ASQ and its constituent scales.

The adjacent flowchart summarizes the process. This document proceeds to provide details on each of these steps.



IDENTIFYING OUTCOMES

The starting point of the validation process was to identify the outcomes relevant to student access and success work and have good evidence that they are associated with the ultimate outcomes of, respectively, student access to higher education, and student success (good outcomes) from higher education.

THE RAPID EVIDENCE REVIEW

For this purpose, a rapid evidence review was conducted, exploring existing evidence as to which outcomes were relevant to the above aim. As part of the rapid review, existing measurement scales from the research literature for each intermediate outcome were assembled.

The full rapid review, which includes its methodology, is available [here](#).

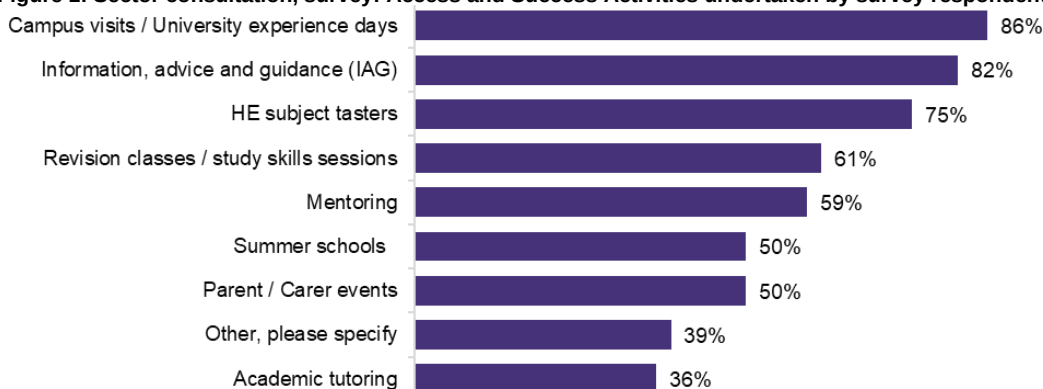
The scales' face validity (simplicity of meaning and relevance to the overall outcome being measured) was considered, alongside the feasibility of future scale deployment as part of evaluations. Based on this, long lists of scales were generated and put into consultation with the higher education sector.

SECTOR CONSULTATION: SURVEY

A sector consultation was conducted in parallel with the rapid evidence review, to understand sector voices on which outcomes were deemed important in terms of access and success activity as well as evaluation. This involved a survey that invited respondents to rank outcomes on the long list above – just over 50 people responded, with 44 individuals providing full responses and offering individual and institutional perspectives.

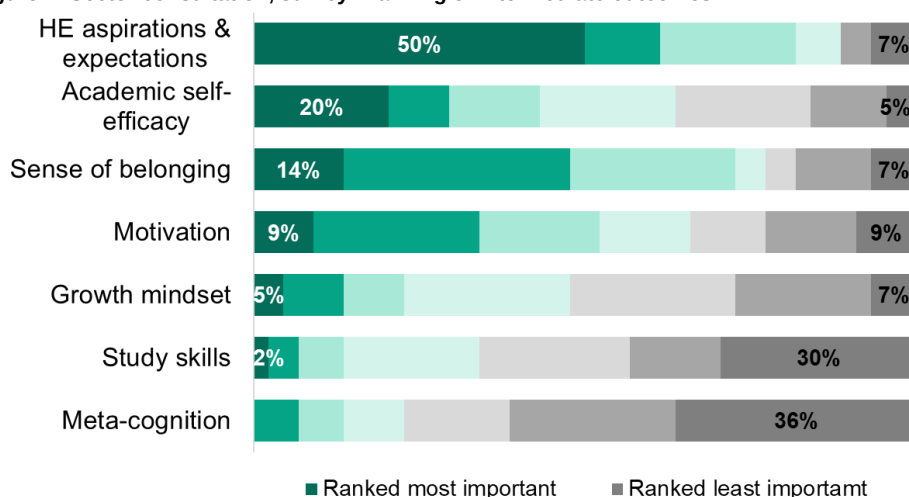
The survey first asked participants to provide brief details about their roles within their institution. It then asked them to indicate the type of student access and student success activities they were undertaking, together with the main outcome they were trying to affect with each type of activity. Choices included, but were not restricted to, academic tutoring, university experience days, HE subject taster events, general information advice and guidance (IAG) provision, mentoring, summer schools, etc. Respondents could also provide their own. Campus visits/university experience days were the most commonly reported activity, by 86% of respondents. This was closely followed by IAG (82%) and HE subject tasters (75%). Academic tutoring was least frequently reported, by about a third of respondents (36%) (see Figure 1).

Figure 1: Sector consultation, survey: Access and Success Activities undertaken by survey respondents



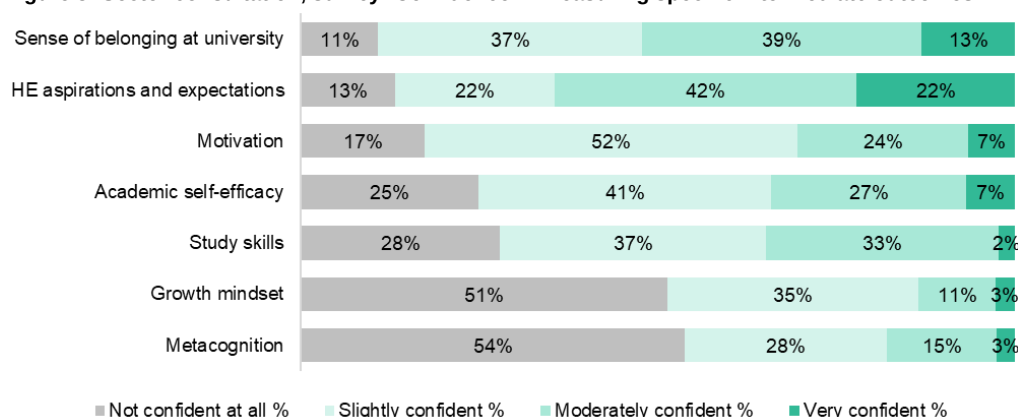
The survey then asked respondents to rank a series of outcomes identified by the rapid evidence review above in terms of their importance for university access and success, as they saw these from their professional perspective. These outcomes were: academic self-efficacy, growth mindset, HE aspirations and expectations, metacognition, motivation, sense of belonging, and study skills. A total of 44 respondents provided rankings for the outcomes, illustrated in Figure 2. Results showed that HE aspirations & expectations were ranked as most important by 50% of respondents, followed by academic self-efficacy (20%), and sense of belonging (14%). Metacognition was ranked as least important by the highest proportion of respondents at 36%, followed by study skills (30%).

Figure 2: Sector consultation, survey: Ranking of intermediate outcomes



Finally, respondents were invited to indicate how often they measured each of these outcomes in evaluations of their student access and success work, and the level of confidence they had in that measurement. The survey closed with the opportunity for participants to indicate any further outcomes of interest, as well as what type of support around measurement and evaluation they would value.

Figure 3: Sector consultation, survey: Confidence in measuring specific intermediate outcomes



As Figures 2 and 3 illustrate, there was overlap between the outcomes ranked as most or least important for HE access and success and the confidence that respondents had in the measures they were using to capture the outcomes. Over half of respondents said they were not confident at all in measuring metacognition (54%) and growth mindset (51%). In general, few respondents reported being very confident in their measures, with the highest proportion saying they were very confident in measuring HE aspirations and expectations (22%).

SECTOR CONSULTATION: FOCUS GROUPS

A further 21 student access and success practitioners were also consulted in five separate focus groups, providing insights about the outcomes their work tackled and which of these they deemed important to be included in the ASQ.

The focus groups were carried out online and were attended by a range of practitioners.

Key messages emerging from the focus groups included:

- Relative ranking of outcomes: HE knowledge, confidence, and aspirations came up frequently as intermediate outcomes that were measured as part of widening participation (WP) interventions and activities. This mirrored the results of the survey.
- Current practice around measurement: practice at the time of the focus groups was that a mixture of self-designed and pre-designed questionnaires was being used to evaluate WP interventions and activities using Type 2 evidence – but there were concerns over the suitability of the measures.

- Need for support: there was a clear consensus that there was uncertainty about how to measure outcomes such as metacognition and study strategies. Practitioners also said that they would like support with measuring outcomes related to sense of belonging and HE knowledge.

Across the focus groups, participants indicated that concerns around intermediate outcomes and related measures were particularly salient around a newly-emerging (at the time of the focus groups) attainment-raising focus, which needed to be handled carefully. Respondents suggested a range of other relevant and related points on which they would welcome support or information, including response rates and how to improve them, support around Theory of Change development, and opportunities to share evaluation learning and findings in a coordinated manner.

Finally, focus group participants identified points around learners' age as driving some of their evaluation design decisions, suggesting that student age was an important consideration in decisions to deploy certain measures.

SHORT-LIST OF SCALES DEVELOPED

Consulting on the set of outcomes with the sector was an important precursor of the scale validation process, ensuring that the intermediate outcomes selected were both relevant to the sector and evidence-based in terms of their link to higher education access and success and their measurement.

The combination of the sector consultation and rapid evidence review resulted in a short list of scales, and of items for each scale. Some outcomes required choosing between different versions of measurement scales, for others there were clear frontrunners in terms of which set of items would most likely be relevant. All scales and outcomes were grounded in the existing evidence previously reviewed. Also feeding into the short list of scales was the analysis of existing data already collected by one of the project partners. This took place alongside the consultation and rapid evidence review, and the results are outlined in what follows.

ANALYSING EXISTING DATA

To inform the development of the short list of items, substantial amounts of data, coming from 23,000+ learners, who The Brilliant Club (a project partner) had engaged as part of their programme, was also analysed.

This data did not include all scales on the short-list, and therefore the analysis was used alongside the rapid evidence review as one further set of information regarding how the scales could operate in the population relevant to access work.

The section below reports on analysis of individual scales for their fit with the theorised structure and for their internal consistency, as emerging from existing data.

SAMPLE

The data available for analysis was anonymous and collected over a period starting in 2019 with a range of learners taking part in The Brilliant Club programmes. Learners varied in age and education stage from Year 7 (age 11/12) to Year 13 (age 17/18) and attended a range of types of schools and colleges across England and Wales. Different parts of the sample had data for different scales.

APPROACH

The analytical approach was to carry out a series of confirmatory factor analyses (in Stata © using the `sem` command), and to separately test for the internal consistency of each respective scale (with Cronbach's alpha as the estimated parameter).

RESULTS

Scale: academic self-efficacy

The academic self-efficacy scale was present in the The Brilliant Club data, but only in a three-item scale format (see Table 1). This differed from the other academic self-efficacy scales identified through the rapid evidence review. This three-item scale (see Table 1) showed good model fit, and good internal consistency.

Table 1: Scale - academic self-efficacy: The Brilliant Club data

	Item	M(SD)	Factor loading
1	I am confident that I can get the grades required to progress to university.	3.69 (0.87)	0.61
2	I have the academic ability to do well at university.	3.91 (0.78)	0.72
3	I could manage with the level of study required at university.	3.74 (0.85)	0.69
N=3,695			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, α = 0.7529

Scale: sense of belonging, pre-entry

The Brilliant Club data also included a scale on prospective sense of belonging, made up of three items. The results of the analysis are reported in Table 2 and indicate both good model fit in the confirmatory factor analysis and good internal consistency. Because this data was collected with a different group of learners than above, it is present for a very large sample, of over 10,000 learners.

Table 2: Scale - sense of belonging, pre-entry: The Brilliant Club data

	Item	M(SD)	Factor loading
1	University is for people like me.	3.77 (0.92)	0.65
2	I would fit in well with others at university.	3.76 (0.87)	0.76
3	I could really be myself at university.	3.91 (0.93)	0.69
N=10,584			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, α = 0.7784

Scale: cognitive strategies

The cognitive strategies scale yielded more mixed results in The Brilliant Club data, despite the large sample size (again over 10,000 learners, same sample as the pre-entry sense of belonging scale). The initial factor analysis suggested that a two-factor structure would be a better model fit than a single-factor solution (testing alternative models in confirmatory factor analysis is a common procedure). In particular, one item loaded onto the second factor: it asked respondents to consider if they could 'clearly explain my ideas, even when writing about complicated things'. While the deliberate intention behind the scale was to capture a range of cognitive strategies (study skills), the focus on writing set this item apart from all the others. The analysis was re-done, therefore, after this item was removed. These results are reported in Table 3. The confirmatory factor analysis this time resulted in a single-factor solution showing a very good fit, but the internal consistency of the scale was lower than ideally expected. However, given the focus and intention of capturing a range of cognitive strategies, the scale was deemed worthy of further testing.

Table 3: Scale – cognitive strategies, The Brilliant Club data

	Item	M (SD)	Factor loading
1	I can find key ideas easily when reading a text for my studies.	3.84 (0.79)	0.54
2	I can assess how reliable information is when reading a text for my studies.	3.81 (0.76)	0.54
4	I can confidently explain my ideas in small group discussions.	3.94 (0.99)	0.42
5	I use a range of learning strategies when I study.	3.60 (0.99)	0.44
N=10,584			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.002, TLI = 1, α = 0.5768

Scale: metacognitive strategies

In The Brilliant Club data, five items from an eight-item metacognitive strategies scale based on the Junior Metacognitive Awareness Inventory was present. Each item was closely scrutinized to understand its meaning and a decision was made to test the five items together as a scale. The results are presented below in Table 4 and show a single-factor structure with very good model fit, and strong internal consistency for the full sample of just over 7,000 learners.

Table 4: Scale - meta-cognitive strategies

	Item	M (SD)	Factor loading
1	I try to use ways of studying that have worked for me before.	4.82 (1.39)	0.51

2	I think of several ways to solve an academic problem.	4.09 (1.65)	0.53
3	I think about what I need to learn before I start studying.	4.47 (1.64)	0.66
4	I ask myself how well I am doing while I am learning something new.	4.10 (1.73)	0.64
5	When I am done with studying, I can tell if I have learned what I wanted to learn.	3.55 (1.65)	0.64
N=7,439			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.018), CFI = 1, SRMR = 0.003, TLI = 1, α = 0.7485

Scale: knowledge of higher education

The final scale with data in The Brilliant Club data set related to a three-item knowledge of higher education scale. These items were very similar to others identified through the rapid evidence review routinely asked of learners resulting in good measures. The Brilliant Club items were specific, in that one of them asked about 'selective' universities, therefore potentially requiring re-development for more widespread use. Table 5 below illustrates the results for the largest sample in this analysis, of just over 14,000 learners. These results suggested very good model fit for a single-factor solution and good internal consistency.

Table 5: Scale – knowledge of higher education

	Item	M (SD)	Factor loading
1	I know what studying at university would be like.	3.43 (1.04)	0.62
2	I understand what a highly selective university is.	2.83 (1.01)	0.70
3	I know the steps I need to take to go to university in the future.	3.54 (1.02)	0.67
N=14,332			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, α = 0.7427

NEXT STEPS

Based on the results of the analysis of existing data above, the sector consultation, and the rapid evidence review, the short-list of items was drawn up.

This short-list was then tested qualitatively with learners, as follows.

COGNITIVE TESTING

The next step of the validation process was a procedure called cognitive testing, which involved speaking directly to twelve individual learners with similar characteristics as those who would eventually engage with these questionnaire scales as part of higher education providers' evaluation work. Participants in this round of cognitive testing were aged between 14 and 22, with older learners responding to scales relevant to student success work and younger learners responding to scales relevant to student access work.

APPROACH

The learners were presented with the relevant short-list of scales and items: learners in schools and colleges with scales and items relevant to access work; learners in higher education across a range of institutions with scales and items relevant to student success work.

The learners were asked for detailed feedback on each of the items and they identified when words were unclear, when phrasing was ambiguous or invited different interpretations, and if the response options were difficult to understand.

Learners provided a range of insights, summarized as follows:

- Prompts and response options were clear and easy to understand.
- The vast majority of items were clear and easy to answer, with the explanations provided by participants as to how they went about answering these questions consistent.
- The term 'university' was occasionally, but rarely, understood to mean any level of education beyond compulsory schooling, suggesting better prompting was required to explain what higher education and/or university meant.
- A range of individual words had the potential to be understood differently by respondents, and required redevelopment: these included the words "understand", "school work" and "learn" in the metacognitive strategies scale; the word "analyse" in the critical thinking/critical engagement with information scale; the word "text" and the phrase "when reading" in the cognitive strategies scale.

SUBGROUP AND YOUNGER AGE ANALYSIS

A separate and subsequent step of the analysis focused on younger age analysis where this data was available, to follow earlier sub-group analysis that looked at the functioning of the scales for specific student sub-groups (not reported here). The younger age analysis included data from learners from age 11 onwards.

NEXT STEPS

Together with information from all previous steps, the items and the scale prompts were then revised, to arrive at a full set of scales and constituent items. These were tested with new survey data, as follows.

TESTING THE SCALES WITH NEW SURVEY DATA

THE FIRST SURVEY

The revised scales (together with their prompts, items, and response options) were tested in a survey of 386 young people (survey #1) that included learners in schools and colleges, as well as young people of similar ages not in higher education, and with early-stages higher education students.

SAMPLE

This survey was undertaken using a commercial survey company, to ensure that respondents included young people of relevant ages who were both in education and not. The disadvantage of using this approach was that the youngest respondent age was 16 (up to 22, to mirror the profile of participants in the cognitive testing); but the advantage was the ability to reach young people not in education and to therefore sample a wider population. This approach was assumed would generate the worst-case scenario in terms of the measurement quality, as educational topics were likely to be less salient (that is, less often encountered) by young people not in education. The approach, however, made no assumptions about the levels at which young people would respond and took the view that scales in the ASQ would need to be as widely applicable as possible.

APPROACH

The collected data was analysed, to understand the internal consistency of each scale (were the items related to each other in the expected way) and their internal validity (were the items coming together as expected given how the measure was meant to work). This included carrying out exploratory (for the brand new) and subsequently confirmatory factor analysis, to test if the hypothesised theoretical structures of the scales were reflected in the collected data.

From this, and the earlier analysis using existing data, most of the scales emerged as good enough for wider use. However, there was variation in how the scales performed, and some items were not as good as initially anticipated, as follows. Further refinement and testing were therefore required.

RESULTS

Scale: Academic self-efficacy

The academic self-efficacy scale consisting of four items displayed extremely good model fit statistics (RMSEA = 0; CFI > .90; SRMR < .08; TLI > .90) and required no modifications (see Table 6). Exploratory factor analysis retained the expected single-factor structure with modest factor loadings. The internal consistency/ reliability coefficient is also relatively modest with $\alpha = 0.6181$.

Table 6: Scale – academic self-efficacy, survey #1

	Item	M(SD)	Factor loading
1	I am confident that I can get the grades required to progress to university.	2.46 (1.32)	0.50
2	I have the academic ability to do well at university.	2.27 (1.28)	0.56
3	I could manage with the level of study required at university.	2.42 (1.33)	0.52
4	I feel confident that I could manage with my studies at university.	2.27 (1.25)	0.45
N=386			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.081), CFI = 1, SRMR = 0.011, TLI = 1.021, $\alpha = 0.6181$

For direct comparison of the scale in The Brilliant Club data, Table 7 below repeats the analysis from Table 1 with data from this first new survey, removing the fourth item and keeping only the sample of learners in education (but not at university/in higher education) (N=174). Overall model fit is improved and the factor loadings for two of the three items is higher. The reliability of the scale is about the same.

Table 7: Scale – academic self-efficacy, learner-sample only, TBC scale version, survey #1

	Item	M(SD)	Factor loading
1	I am confident that I can get the grades required to progress to university.	2.48 (1.34)	0.53
2	I have the academic ability to do well at university.	2.34 (1.24)	0.54
3	I could manage with the level of study required at university.	2.32 (1.31)	0.55
N=174			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, α = 0.6131

Scale: sense of belonging, pre-entry

The sense of belonging scale was tested in this first survey in a version consisting of four items. Focusing on the sample of young people in education (but not at university/in higher education), only, the results (see Table 8) below indicate a mixed picture, of good model fit for the single-factor solution, but relatively modest internal consistency (Cronbach's alpha approximately 0.5).

Table 8: Scale – sense of belonging, pre-entry, learner sample, survey #1

	Item	M(SD)	Factor loading
1	University is for people like me.	2.5 (1.26)	0.43
2	I would fit in well academically with others at university.	2.34 (1.29)	0.42
3	I would fit in well socially with others at university.	2.35 (1.27)	0.54
4	I could really be myself at university.	2.39 (1.30)	0.30
N=174			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.099), CFI = 1, SRMR = 0.014, TLI = 1.122, α = 0.5027

Scale: sense of belonging, post-entry

A first version of the scale drawing on an existing measure by King's College London was tested with data from the first survey. The results, based on a small sample of young people in education (at university/in higher education in general) suggests good model fit for a single-factor solution for the construct, but relatively modest scale internal consistency (Cronbach's alpha approximately 0.5). (see Table 9).

Table 9: Scale - sense of belonging, post-entry, KCL version, HE learner sample, survey #1

	Item	M (SD)	Factor loading
1	I made the right decision in choosing to study at this university.	2.16 (1.34)	0.40
2	I feel supported by this university.	2.39 (1.45)	0.53
3	I feel optimistic about the academic year ahead.	2.25 (1.34)	0.41
N=67			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, α = 0.4925

A second version of the scale initially generated and tested in Pedler et al. (2022) was also tested for the post-entry sense of belonging construct. These results (see Table 10) are reported below, and they are noteworthy in that they are weaker than those reported in the original paper developing the measure. The results in Table 10 may be taken to represent the worst-case results in terms of the functioning of the scale, given the size and nature of the sample.

Table 10: Scale – sense of belonging, post-entry, Pedler et al version, HE learner sample, new survey #1

	Item	M (SD)	Factor loading
1	I feel I belong at university.	2.21 (1.33)	0.42
2	I feel a sense of belonging at university.	2.27 (1.41)	0.55
3	I feel I am a member of the university community.	2.43 (1.38)	0.34
4	I see myself as part of the university community.	2.37 (1.41)	0.45
N=67			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.193), CFI = 1, SRMR = 0.029, TLI = 1.261, α = 0.5273

Scale: cognitive study strategies

The cognitive study strategies scale tested in this first new-data survey consisted of five items. The initial exploratory factor analysis retained a two-factor structure with poor factor loadings (see Table 11). By removing item 3 which yielded the lowest factor loading, a single-factor structure with no required modifications was retained (see Table 12). The model has very good overall model fit but relatively small factor loading and reliability. Repeating the analysis (not tabled) on the student population did not improve the factor loading nor the scale's internal consistency ($\alpha = 0.48$).

Table 11: Scale – cognitive study strategies, survey #1

	Item	M(SD)	Factor 1 loading	Factor 2 loading
1	I can find key ideas easily when reading a text for my studies.	2.19 (1.27)	0.43	-0.05
2	I can assess how reliable information is when reading a text for my studies.	2.22 (1.29)	0.47	-0.04
3	I can clearly explain my ideas, even when writing about complicated things.	2.30 (1.30)	0.33	0.16
4	I can confidently explain my ideas in small group discussions.	2.30 (1.36)	0.35	-0.10
5	I use a range of learning strategies when I study.	2.33 (1.34)	0.35	-0.15
N=386				

Model fit after adjusting for covariance between items 3 and 4; and items 3 and 5: RMSEA = 0.000 (90% CI: 0.000, .), CFI = 1, SRMR = 0.003, TLI = 1, $\alpha = 0.4944$

Table 12: Scale - cognitive study strategies, re-specified version, survey #1

	Item	M(SD)	Factor loading
1	I can find key ideas easily when reading a text for my studies.	2.19 (1.27)	0.43
2	I can assess how reliable information is when reading a text for my studies.	2.22 (1.29)	0.45
4	I can confidently explain my ideas in small group discussions.	2.30 (1.36)	0.31
5	I use a range of learning strategies when I study.	2.33 (1.34)	0.39
N=386			

Model fit: RMSEA = 0.000 (90% CI: 0.000, .), CFI = 1, SRMR = 0.001, TLI = 1.096, $\alpha = 0.4661$

Scale: metacognitive strategies

The initial exploratory factor analysis retained a four-factor structure for the eight-item metacognitive strategies scale. This was not in keeping with the theorised single-factor solution and required substantial modification to achieve a single-factor solution, including the removal of items 7 and 8 (see Table 13). The internal consistency measure for the scale was low, with Cronbach's alpha below 0.5 (0.46).

Table 13: Scale – metacognitive strategies, survey #1

	Item	M (SD)	Factor loading
1	I can tell when I have understood a concept or idea.	2.15 (1.34)	0.42
2	I can motivate myself to study when I need to.	2.41 (1.29)	
3	I try to use ways of studying that have worked for me before.	2.37 (1.44)	0.37
4	I learn best when I already know something about the topic.	2.33 (1.38)	
5	When I am done with studying, I can tell if I have learned what I wanted to learn.	2.18 (1.31)	0.46
6	I think of several ways to solve an academic problem and then choose the best way.	2.20 (1.23)	0.32
7	I think about what I need to learn before I start studying.	2.19 (1.30)	N/A
8	I ask myself how well I am doing while I am learning something new.	2.27 (1.26)	N/A
N=386			

Model fit: RMSEA = 0.019 (90% CI: 0.000, 0.105), CFI = 0.996, SRMR = 0.020, TLI = 0.987, $\alpha = 0.4630$

In addition to the results in Table 13 above, which are based on responses by the full sample, the best-achievable solution for respondents who were in education (but not in higher education/at university, i.e. learners) was a two-factor solution that also required the removal of items 2 and 4 from the original scale (see Table 14). The results in Table 14 together with the fact that the scale

performed differently for the overall sample compared to this group of learners suggested that this scale was not suitable for this latter group.

Table 14: Scale – metacognitive strategies, learner sample, new survey #1

	Item	Factor 1 loading	Factor 2 loading
1	I can tell when I have understood a concept or idea.	0.42	-0.01
3	I try to use ways of studying that have worked for me before.	0.36	-0.01
5	When I am done with studying, I can tell if I have learned what I wanted to learn.	0.52	0.000
6	I think of several ways to solve an academic problem and then choose the best way.	0.28	0.03
N=174			

Model fit: RMSEA = 0.029 (90% CI: 0.000, 0.112), CFI = 0.984, SRMR = 0.024, TLI = 0.963, α = 0.421

Scale: critical thinking/critical engagement with information

The critical engagement with information scale was sourced from Vermunt et al. (2018) and consisted of seven items. The initial exploratory factor analysis retained a three-factor structure (not tabled). Removing items 3 and 5 that yielded the lowest factor loadings retained the desired single-factor structure with a very good overall model fit and no required modifications (see Table 15). Within the overall good fit, the factor loadings of each respective items were relatively low, ranging from 0.37 and 0.45. The Cronbach's α was 0.51. Repeating the analysis on the student population did not improve the scale's reliability (α = 0.43) and retained a three-factor structure (even after removing items 3 and 5, not tabled).

Table 15: Scale – critical engagement with information, survey #1

	Item	M (SD)	Factor loading
1	I try to formulate the main points of any text I read for my studies in my own words.	2.20 (1.35)	0.45
2	When I start reading a new text related to my studies, I first think about the most appropriate way to understand it.	2.04 (1.19)	0.40
3	When I have difficulty grasping a particular topic I am studying, I try to analyse why it is difficult for me.	2.30 (1.25)	
4	I try to answer questions about the topic I am studying which I come up with myself.	2.29 (1.28)	0.34
5	I try to think up other examples and problems besides the ones given in the study materials or by the lecturer.	2.17 (1.21)	
6	I try to describe the content of a paragraph in my own words.	2.12 (1.30)	0.40
7	I also pursue learning goals that have not been set by the lecturers but by myself.	2.19 (1.21)	0.37
N=386			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.046), CFI = 1, SRMR = 0.017, TLI = 1.062, α = 0.5079

Scale: knowledge of higher education

The knowledge of higher education scale tested in this first new survey consisted of four items. The exploratory factor analysis using the learner population (in education but not HE/at university) retained a single-factor structure, though only after modifying for covariance between items 1 and 2 (see Table 16) and removing the last item. The scale showed modest internal consistency (α = 0.43).

Table 16: Scale – knowledge of higher education, survey #1

	Item	M (SD)	Factor loading
1	I know what studying at university would be like.	2.36 (1.27)	0.42
2	I know what being a student at university would be like.	2.41 (1.23)	0.49
3	I know how studying at university is different from studying in school or at college.	2.44 (1.37)	0.32
4	I know the steps I need to take to go to university in the future.	2.39 (1.36)	N/A
N=174			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1.000, α = 0.4332

Scale: higher education intentions and expectations

A final four-item scale around higher education intentions and expectations was tested. The results of the analysis using the non-learner sample only suggested good model fit for the single-factor solution,

though with relatively low loadings for the final item (item 4 in Table 17 below) and modest internal consistency ($\alpha = 0.56$).

Table 17: Scale – higher education intentions and expectations, survey #1

	Item	M(SD)	Factor loading
1	I would like to go to university in the future.	2.67 (1.37)	0.54
2	I am thinking about applying to university in the future.	2.51 (1.37)	0.51
3	I believe I will go to university in the future.	2.79 (1.35)	0.43
4	I believe that if I apply to university, I will get in.	2.45 (1.29)	0.37
N=212			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.078), CFI = 1.000, SRMR = 0.010, TLI = 1.081, $\alpha = 0.5642$

THE SECOND AND THIRD SURVEYS

After the removal of items that did not perform well (where the analysis indicated that this would retain the integrity of the scale) and further refinement of specific words within a small set of items, two further small-scale surveys (the second, and respectively, third survey in this study) were conducted.

The second survey included a sample of 121 sixth-form learners specifically testing scales relevant to access work (survey #2); the third survey included a sample of 52 higher education students, who only responded to scales relevant to student success at higher education (survey #3). Across both these survey samples, only some respondents provided full responses: between 80 and 100 individuals for the sixth-form learner survey; and between 33 and 40 individuals for the survey of higher education learners. Although these figures are not indicative of likely achievable response rates (because they are not response rates as such; and because these questionnaires included many more items than would normally be shown to learners), they do both indicate that keeping the questionnaires as brief as possible is desirable.

These surveys also offered the option of testing slight variations to the response options, including the inclusion of a 'don't know' option, which did not prove either popular or needed.

RESULTS

Scale: sense of belonging, post-entry

Both versions of the sense of belonging scale post-entry (as above) were tested with the higher education learner sample, as follows.

Table 18: Scale – sense of belonging, post-entry, KCL version, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I made the right decision in choosing to study at this university.	3.79 (1.20)	0.81	0%
2	I feel supported by this university.	3.88 (1.10)	0.75	3.03%
3	I feel optimistic about the academic year ahead.	3.78 (1.21)	0.96	5.88%
N=33				

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, $\alpha = 0.88$

Table 19: Scale – sense of belonging, post-entry, Pedler et al. version, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I feel I belong at university.	3.48 (1.30)	0.85	2.94%
2	I feel a sense of belonging at university.	3.45 (1.30)	0.75	2.94%
3	I feel I am a member of the university community.	3.27 (1.20)	0.89	2.94%
4	I see myself as part of the university community.	3.53 (1.28)	0.96	0%
N=33				

Model fit: RMSEA = 0.089 (90% CI: 0.000, 0.374), CFI = 0.995, SRMR = 0.022, TLI = 0.985, $\alpha = 0.92$

The second scale version yielded better results from an internal consistency (alpha) perspective, because of a very high correlation between item 3 and item 4. The results of the confirmatory factor analysis suggest that this scale is actually a less good fit compared to the first version, however. From a simplicity perspective, items on both scales are relatively easy to answer, with only item 3 of 3 on the first scale (optimistic about the year ahead) showing (just) over 5% of 'don't know' responses. A

better solution would be to combine the two different scales. This 'composite' scale worked as one factor, had good reliability (alpha), and very small proportions of 'don't know' answers.

Table 20: Scale – sense of belonging, post-entry, new version, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I made the right decision in choosing to study at this university.	3.79 (1.20)	0.73	0%
2	I feel supported by this university	3.88 (1.10)	0.79	3.03%
3	I feel I belong at university.	3.48 (1.30)	0.95	2.94%
4	I see myself as part of the university community.	3.53 (1.28)	0.88	0%
N=33				

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.357), CFI = 1, SRMR = 0.024, TLI = 1.003, α = 0.90

Scale: Cognitive study strategies

The cognitive study strategies scale consisted of five items. In previously reported analysis, the initial exploratory factor analysis retained a two-factor structure with poor factor loadings. By removing item 3 which yielded the lowest factor loading a single-factor structure was retained, requiring no modifications. However, because the internal consistency (reliability/alpha) was very low in the survey #1 sample, this scale was re-tested in both new surveys. The results are illustrated in Table 21 below for the higher education learner sample.

Table 21: Scale - cognitive study strategies, HE learner sample, survey #3

	Item	M(SD)	Factor loading	'Don't know'
1	I can find key ideas easily when reading a text for my studies.	3.89 (0.85)	0.67	2.94%
2	I can assess how reliable information is when reading a text for my studies.	3.8 (0.9)	0.89	0%
3	I can clearly explain my ideas, even when writing about complicated things.	3.6 (1.08)	0.62	0%
4	I can confidently explain my ideas in small group discussions.	3.89 (1.04)	0.52	0%
5	I use a range of learning strategies when I study.	3.75 (0.96)	0.27	0%
N=36				

RMSEA = 0.033 (90% CI: 0.000, 0.243), CFI = 0.995, SRMR = 0.072, TLI = 0.990, α = 0.73

The scale behaved slightly differently from the results of the existing data analysis and the results from the first new survey. A *different* item loaded fairly weakly onto the single-factor modelled in the confirmatory factor analysis: item 5 (from Table 21 above). Potentially this is because there are different ways of understanding what 'learning strategies' are. There were some hints towards this in the cognitive interviewing, but on its own, that was not a definitive conclusion to remove the item. However, with the results above, this might be feasible. Removing item 5 and retaining a 4-item version of the scale results in better model fit, better internal consistency (alpha) and therefore a usable scale.

Table 22: Scale – cognitive study strategies, reduced version, HE learner sample, survey #3

	Item	M(SD)	Factor loading	'Don't know'
1	I can find key ideas easily when reading a text for my studies.	3.89 (0.85)	0.66	2.94%
2	I can assess how reliable information is when reading a text for my studies.	3.8 (0.9)	0.91	0%
3	I can clearly explain my ideas, even when writing about complicated things	3.6 (1.08)	0.62	0%
4	I can confidently explain my ideas in small group discussions	3.89 (1.04)	0.50	0%
N=36				

RMSEA = 0.000 (90% CI: 0.000, 0.2469), CFI = 1, SRMR = 0.029, TLI = 1, α = 0.76

In the school sample, with a higher response rate (84 respondents), the mean scores for each item were very similar to those in the higher education sample. The factor loadings also followed a similar pattern, though with lower absolute values. The internal consistency of the scale was slightly lower, at 0.66.

Table 23: Scale – cognitive study strategies, sixth-form learner sample, survey #2

	Item	M(SD)	Factor loading	'Don't know'
1	I can find key ideas easily when reading a text for my studies.	3.76 (1.06)	0.51	0%
2	I can assess how reliable information is when reading a text for my studies.	3.65 (0.96)	0.48	3.5%
3	I can clearly explain my ideas, even when writing about complicated things	3.58 (0.96)	0.84	1.1%
4	I can confidently explain my ideas in small group discussions	3.91 (1.16)	0.57	2.3%
5	I use a range of learning strategies when I study	3.33 (1.28)	0.31	0%
N=84				

RMSEA = 0.000 (90% CI: 0.000, 0.157), CFI = 1, SRMR = 0.046, TLI = 1.002, α = 0.66

Item 5 was again problematic, as in the higher education sample. The re-run analysis, including only the first 4 items, suggested a slightly poorer model fit, but higher internal consistency, and higher factor loadings for 2 of the items (lower or the same for the other two items).

Table 24: Scale - cognitive study strategies, reduced version, sixth form learner sample, survey #2

	Item	M(SD)	Factor loading	'Don't know'
1	I can find key ideas easily when reading a text for my studies.	3.76 (1.06)	0.55	0%
2	I can assess how reliable information is when reading a text for my studies.	3.65 (0.96)	0.48	3.5%
3	I can clearly explain my ideas, even when writing about complicated things	3.58 (0.96)	0.82	1.1%
4	I can confidently explain my ideas in small group discussions	3.91 (1.16)	0.58	2.3%
N=84				

RMSEA = 0.000 (90% CI: 0.000, 0.225), CFI = 0.975, SRMR = 0.042, TLI = 0.925, α = 0.70

Overall, the reduced scale had relatively mixed results (given the earlier Brilliant Club data and survey #1 analysis) but was worth testing in the second phase of the study, especially as it was a short study skills scale that learners in the cognitive testing did not object to.

Scale: Meta-cognitive strategies

There were mixed results from The Brilliant Club data and survey #1 results reported above. The results were just acceptable in The Brilliant Club data, suggesting that the scale was not ideal for use with the desired audience. Therefore, this scale was tested again with the further (much smaller) higher education sample. The results are shown in Table 25 below. The overall fit for the full scale was within acceptable limits and the internal reliability was good (α = 0.71). However, some of the factor loadings were very small.

Table 25: Scale – metacognitive strategies, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I can tell when I have understood a concept or idea.	4.41 (0.61)	0.74	0%
2	I can motivate myself to study when I need to.	3.64 (1.20)	0.74	0%
3	I try to use ways of studying that have worked for me before	4.03 (0.94)	0.67	0%
4	I learn best when I already know something about the topic	4.15 (0.72)	0.25	0%
5	When I am done with studying, I can tell if I have learned what I wanted to learn.	3.97 (0.85)	0.53	0%
6	I think of several ways to solve an academic problem and then choose the best way.	3.53 (1.05)	0.65	0%
7	I think about what I need to learn before I start studying.	4.06 (0.81)	0.44	0%
8	I ask myself how well I am doing while I am learning something new.	3.50 (1.16)	0.17	0%
N=31				

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.133), CFI = 1, SRMR = 0.083, TLI = 1.098, α = 0.71

A further, reduced, specification was then tested, both in the original existing data (not tabled) and in this small sample. Returning to the original 8-item scale and removing all items with loadings below 0.5 in this specification, a final version of the scale was tested. Although the factor loading for item 3

was just below 0.5, the overall model fit was good (see Table 26 below), and the internal consistency was also good (removing item 3 resulted in a much poorer model fit – not tabled).

Table 26: Scale – metacognitive strategies, reduced version, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I can tell when I have understood a concept or idea.	4.41 (0.61)	0.73	0%
2	I can motivate myself to study when I need to.	3.64 (1.20)	0.77	0%
3	I try to use ways of studying that have worked for me before.	4.03 (0.94)	0.48	0%
5	When I am done with studying, I can tell if I have learned what I wanted to learn.	3.97 (0.85)	0.52	0%
6	I think of several ways to solve an academic problem and then choose the best way.	3.53 (1.05)	0.66	0%
N=31				

Model fit: RMSEA = 0.033 (90% CI: 0.000, 0.250), CFI = 0.995, SRMR = 0.059, TLI = 0.99, α = 0.75

Looking at the cognitive interviewing, the items in this final specification (see Table 26 above) were the simplest ones to understand. Given the performance of the scale with younger learners in the previous analysis, this scale emerged from all the analysis so far as only suitable for learners in higher education (that is, relevant to student success work).

Scale: Critical engagement with information

This seven-item scale had previously performed modestly in the survey #1 sample, despite initial data on its development suggesting good psychometric features with higher education student populations. The scale was therefore tested in both survey #2 and survey #3. With the caveat of the relatively small sample, the results show high internal consistency (0.79) and also the mean responses for each item that are substantially higher than in the survey #1 sample, potentially suggesting that the higher education population is different from the general population in relation to approaches to learning (even if only in terms of the salience of terms and topics covered by the items). Only the last item (around learning goals in Table 27 below) showed noteworthy levels of 'don't know' answers, at 7.5%.

Table 27: Scale – critical engagement with information, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I try to formulate the main points of any text I read for my studies in my own words.	4.18 (0.81)	0.72	0%
2	When I start reading a new text related to my studies, I first think about the most appropriate way to understand it.	3.9 (0.93)	0.42	0%
3	When I have difficulty grasping a particular topic I am studying, I try to analyse why it is difficult for me.	3.5 (1.11)	0.56	0%
4	I try to answer questions about the topic I am studying which I come up with myself.	3.55 (1.18)	0.58	0%
5	I try to think up other examples and problems besides the ones given in the study materials or by the lecturer.	3.41 (1.16)	0.61	2.5%
6	I try to describe the content of a paragraph in my own words.	4.2 (0.85)	0.67	0%
7	I also pursue learning goals that have not been set by the lecturers but by myself.	3.81 (1.10)	0.66	7.5%
N=40				

Model fit: RMSEA = 0.094 (90% CI: 0.000, 0.200), CFI = 0.925, SRMR = 0.077, TLI = 0.88, α = 0.79

The 'reduced' version of the scale, removing the item that had 7.5% 'don't know' responses, resulted in an acceptable model fit, and very similar internal consistency.

Table 28: Scale – critical engagement with information, reduced version, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I try to formulate the main points of any text I read for my studies in my own words.	4.18 (0.81)	0.65	0%
2	When I start reading a new text related to my studies, I first think about the most appropriate way to understand it.	3.9 (0.93)	0.39	0%
3	When I have difficulty grasping a particular topic I am studying, I try to analyse why it is difficult for me.	3.5 (1.11)	0.55	0%
4	I try to answer questions about the topic I am studying which I come up with myself.	3.55 (1.18)	0.58	0%

5	I try to think up other examples and problems besides the ones given in the study materials or by the lecturer.	3.41 (1.16)	0.68	2.5%
6	I try to describe the content of a paragraph in my own words.	4.2 (0.85)	0.62	0%
N=40				

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.180), CFI = 1, SRMR = 0.067, TLI = 1.007, α = 0.76

To address issues of length and general complexity, the scale was further 'reduced', removing the item that had a low factor loading (item 2 in Table 28 above). The results were better from a model fit perspective for a single-factor solution, and the internal consistency remained stable (Table 29 below).

Table 29: Scale – critical engagement with information, further reduced version, HE learner sample, survey #3

	Item	M (SD)	Factor loading	'Don't know'
1	I try to formulate the main points of any text I read for my studies in my own words.	4.18 (0.81)	0.65	0%
3	When I have difficulty grasping a particular topic I am studying, I try to analyse why it is difficult for me.	3.5 (1.11)	0.55	0%
4	I try to answer questions about the topic I am studying which I come up with myself.	3.55 (1.18)	0.58	0%
5	I try to think up other examples and problems besides the ones given in the study materials or by the lecturer.	3.41 (1.16)	0.68	2.5%
6	I try to describe the content of a paragraph in my own words.	4.2 (0.85)	0.62	0%
N=40				

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.180), CFI = 1, SRMR = 0.059, TLI = 0.984, α = 0.76

The results in the school sample (slightly larger, at 76 observations) were weak (Table 30 below). The model fit was weak and the internal consistency was modest. Some of the factor loadings were also very low. Item 3 in particular (see below) essentially did not load on the factor at all. This is potentially because sixth-form based respondents struggled to engage with the self-regulation behaviour that this item reflects. This was not surprising given that the scale was initially developed to be used in higher education populations.

Table 30: Scale – critical engagement with information, original version, sixth form learner sample, survey #2

	Item	M (SD)	Factor loading	'Don't know'
1	I try to formulate the main points of any text I read for my studies in my own words.	3.76 (0.99)	0.73	1.1%
2	When I start reading a new text related to my studies, I first think about the most appropriate way to understand it.	3.91 (0.98)	0.31	3.3%
3	When I have difficulty grasping a particular topic I am studying, I try to analyse why it is difficult for me.	3.67 (1.15)	0.01	2.3%
4	I try to answer questions about the topic I am studying which I come up with myself.	2.96 (1.16)	0.30	1.1%
5	I try to think up other examples and problems besides the ones given in the study materials or by the lecturer.	3.34 (1.16)	0.32	2.2%
6	I try to describe the content of a paragraph in my own words.	3.79 (0.98)	0.65	3.3%
7	I also pursue learning goals that have not been set by the lecturers but by myself.	4.15 (1.12)	0.45	4.4%
N=76				

Model fit: RMSEA = 0.141 (90% CI: 0.083, 0.201), CFI = 0.656, SRMR = 0.107, TLI = 0.484, α = 0.55

The 6-item version of the scale above was therefore retained for the following phase of the work, to be applied to higher education populations only.

Scale: knowledge of higher education

Earlier analysis using data from the first new survey and respectively The Brilliant Club data showed mixed results for this four-item knowledge of higher education scale. The Brilliant Club data revealed good internal consistency and good model fit, but similar items tested with the 'real-world' sample in survey #1 yielded far more modest results. The scale was therefore tested with sixth-form learners.

The results (see Table 31) were poor, with the single-factor solution model not converging. This was likely due to the pattern of association between the items of the scale: simple pair-wise correlations found a null linear association ($r=0$) between item 4 and item 3, and generally a pattern of either very low correlations (item 1 and 2, $r=0.04$; item 2 and item 3, $r=0.15$); or moderate correlations (item 1 and 3, $r=-.64$; item 2 and 4, $r=0.51$).

Table 31: Scale – knowledge of higher education, sixth form learner sample, survey #2

	Item	M (SD)	Factor loading	'Don't know'
1	I know what studying at university would be like.	4.76(0.56)	N/A	0.6%
2	I know what being a student at university would be like.	3.39 (1.04)	N/A	3.6%
3	I know how studying at university is different from studying in school or at college.	4.86 (0.42)	N/A	0%
4	I know the steps I need to take to go to university in the future.	3.77 (1.04)	N/A	0%
N=82				

Model fit: not converged; $\alpha = 0.49$

Taking together all the results of the analyses from the relevant new surveys and prior existing data, this scale would not be appropriate for wide-ranging deployment in this form.

Scale: higher education intentions and expectations

This final higher education related scale displayed items with under 5% of 'Don't know' answers. While the model fit was within acceptable standards, the internal consistency coefficient (alpha) was modest. Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.133), CFI = 0.912, SRMR = 0.070, TLI = 0.735, $\alpha = 0.55$

The covariance analysis suggested that removing item 1 would increase the internal consistency to 0.63, but this would be illogical from a user perspective, as item 1 is "I would like to go to university in the future" and therefore a 'reference' item in terms of the face validity of the scale (and one that none of the participants in the cognitive interviews suggested any issues with).

Table 32: Scale - higher education intentions and expectations, sixth-form learners, survey #2

	Item	M(SD)	Factor loading	'Don't know'
1	I would like to go to university in the future.	3.14 (1.10)	0.55	3.6%
2	I am thinking about applying to university in the future.	4.48 (0.81)	0.85	4.8%
3	I believe I will go to university in the future.	3.96 (1.05)	0.45	0%
4	I believe that if I apply to university, I will get in.	4.09 (0.96)	0.57	4.8%
N=79				

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.133), CFI = 0.912, SRMR = 0.070, TLI = 0.735, $\alpha = 0.55$

Scale: new combined version of the higher education scales

The results of the analysis across the relevant new surveys suggested the higher education scales were not as strong as would be expected for at-scale administration. However, the consultation results suggested strongly that this was an outcome of high relevance and importance to the sector. To address the need to retain it, the two scales were combined into a single revised higher education expectations scale.

Table 33: Scale – higher education expectations, new composite scale sixth-form learners, survey #2

	Item	M (SD)	Factor loading	'Don't know'
1	I know what studying at university would be like.	4.76(0.56)	0.74	0.6%
2	I know what being a student at university would be like.	3.39 (1.04)	0.15	3.6%
3	I know how studying at university is different from studying in school or at college.	4.86 (0.42)	0.54	0%
4	I know the steps I need to take to go to university in the future.	3.77 (1.04)	0.03	0%
5	I would like to go to university in the future.	3.14 (1.10)	0.04	3.6%
6	I am thinking about applying to university in the future.	4.48 (0.81)	0.89	4.8%
7	I believe I will go to university in the future.	3.96 (1.05)	0.40	0%
8	I believe that if I apply to university, I will get in.	4.09 (0.96)	0.47	4.8%
N=79				

Model fit: RMSEA = 0.296 (90% CI: 0.252, 0.342), CFI = 0.395, SRMR = 0.209, TLI = 0.153, $\alpha = 0.72$

As expected, given the combination of items, the single-factor model was not a good fit, even though the internal consistency of the scale was high (0.72). Only items with a high factor loading were retained and a final version of the scale was tested (see Table 34 below).

Table 34: Scale - higher education expectations, new composite scale sixth-form learners, survey #2

	Item	M (SD)	Factor loading	'Don't know'
1	I know what studying at university would be like.	4.76(0.56)	0.74	0.6%
3	I know how studying at university is different from studying in school or at college.	4.86 (0.42)	0.54	0%
6	I am thinking about applying to university in the future.	4.48 (0.81)	0.89	4.8%
8	I believe that if I apply to university, I will get in.	4.09 (0.96)	0.47	4.8%
	N=82			

Model fit: RMSEA = 0.322 (90% CI: 0.195, 0.468), CFI = 0.836, SRMR = 0.088, TLI = 0.508, α = 0.70

Although the above results fell outside expected ranges, when combined with the results of The Brilliant Club data analysis and of the survey #1 results, which suggested that the scales could be retained (though with not ideal model fit), this scale was retained for the next phase of the work, to potentially be split into a smaller scale and a separate item. This would reflect the importance of the scale for the sector and bring together the somewhat diverging results across all the sources of data analysed here.

SUB-GROUP ANALYSES

Across all these analyses, when sample sizes allowed, the analysis also looked at sub-samples of learners with characteristics similar to some of the key target groups in student access and respectively student success work. This included young people eligible for free school meals during their schooling, learners with English as an additional language, or those who were (or would be) the first in their family to progress to higher education. While small variations were observed in the respective factor analysis results, factor loadings for individual items, and overall scale internal consistency, these were minor, and suggested that the scales did not operate fundamentally differently for the different sub-samples tested.

NEXT STEPS

Using the results from the survey validation, a preliminary set of scales and constituent items, together with questionnaire prompts and response options was assembled. These scales had sufficiently good internal consistency, behaved as expected in terms of their internal structure, and were composed of items that learners of a variety of backgrounds could easily understand and answer.

TESTING THE SCALES WITH DATA FROM HIGHER EDUCATION PROVIDERS

These scales were made available to the wider higher education sector in November 2022. Interested higher education providers and other relevant organisations were invited to deploy the measures in their evaluation work and return both collected data and any feedback to TASO.

SAMPLE

A total of thirteen higher education providers and organisations returned data and/or feedback.

The data referred to 3,340 learners, most of them responding to scales relevant to access work, but with data on all scales in the provided set. A total of 426 observations were sourced via the Higher Education Access Tracker (HEAT), with several HEPs choosing to use (and therefore test) HEAT's functionality of survey data collection with these scales.

Additionally, responding providers and organisations also provided, where possible, attainment data and background information about respondents, while always protecting their anonymity.

The attainment data took a variety of forms, including: GCSE results in Maths/English; number of GCSEs previously attained; number of GCSEs previously attained with specific marks (6 to 9; or 4 to 9; or 5 to 9); specific scores in Maths, English Language, or English Literature that did not come from statutory GCSE testing.

The background information included gender, ethnic background (a broadly coded categorical variable to ensure non-identifiability of data), POLAR (higher education participation by neighbourhood) quintiles, IMD (Index of Multiple Deprivation) quintiles; and also measures capturing whether individual respondents had ever been eligible for free school meals, had ever been in care or had a special educational need or disability. This latter set of data was available for a small portion of the sample only.

APPROACH

The resulting data was analysed following similar procedures as above. Confirmation factor analyses were undertaken to explore the underlying factor structure of each respective scale – that is, to test the expectation that each scale measured one single outcome in a manner consistent with each item’s meaning. Reliability analyses looked at the internal consistency of the scales, and the extent to which the items related to each other as expected.

Other analyses tested the robustness of the scales, comparing between a randomly selected set of constituent items to understand if similar findings would be achieved (which they were), and yet others looked to ascertain whether the samples being employed skewed the results in any important way (they did not).

Sub-group analyses like the ones carried out previously were undertaken when the data allowed, again suggesting scale behaviour that was consistent across sub-groups.

A final analytical step was to consider the relationships between each respective scale and the external measures of attainment provided by the providers and organisations engaged in this testing phase. These results met the hypothesised relationship, though for one scale they were weaker than expected (as outlined below). The relationships to the external measures were hypothesised to be in the weak to modest to moderate range, because the attainment data was collected before the deployment of the measures and because the sampling strategies employed by each respective participating higher education provider (whereby they administered the scales to learners they normally worked with) meant that the samples were both self- and institution-selected into the programming and therefore the data collection, generating relatively homogenous samples. This analysis therefore does not work as a perfect predictive validity analysis, and instead looks at the broad association with relevant external measures of interest to both learners and higher education providers. An approach to provide further insights into the predictive validity of these scales would be to collect data on further measures hypothesised to be associated with these scales at a point in time after their initial deployment with learners and test the respective relationships between each scale and these measures. At this stage, however, the current analysis provides sufficient evidence, consistent with prior evidence derived across this piece of work, of the scales below functioning as hypothesised, as follows.

RESULTS

Scale: Sense of belonging, pre-entry

A total of 1,067 observations had data for this scale. It showed good internal consistency, with $\alpha=0.69$. The factor analysis confirmed the single-factor structure also evidence in all the above analyses, with very good model fit, and mostly high factor loadings by individual items. Using a smaller sample for which external attainment data was available (ranging between 365 and 775 observations respectively), the relationships (Pearson correlation) to Maths and respectively English GCSE scores were small, but as expected, in the $r=0.1$ to $r=0.15$, both statistically significant. The relationship to the number of GCSEs attained at specific levels was weaker, but this was as expected.

Table 35: Scale – Sense of belonging, pre-entry, HEP sample

	Item	M(SD)	Factor loading
1	University is for people like me.	3.97 (0.85)	0.64
2	I would fit in well academically with others at university.	4.11 (0.72)	0.79
3	I would fit in well socially with others at university.	3.96 (0.85)	0.56
N=1,066			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, $\alpha = 0.6915$

Scale: Sense of belonging, post-entry

A smaller sample of 472 observations were present for this scale. As shown in Table 26 below, it showed good results for the hypothesised single-factor solution (RMSEA was slightly too high – though within range for some rules of thumb around fit indices threshold values, all other indices showed good fit), and very good internal consistency ($\alpha = 0.82$). The relationships to measures of external attainment, sourced from GCSE results in Maths and English Language for this sample of students studying in participating higher education providers, were relatively strong ($r=0.18$ and respectively $r=0.3$) but were based on a very small sample of 24 observations with data on all relevant items.

Table 36: Scale – Sense of belonging, post-entry, HEP sample

	Item	M(SD)	Factor loading
1	I made the right decision in choosing to study at this university.	3.72 (1.40)	0.63
2	I feel supported by this university.	3.25 (1.49)	0.70
3	I feel I belong at university.	3.32 (1.45)	0.84
4	I see myself as part of the university community.	3.22 (1.37)	0.76
N=472			

Model fit: RMSEA = 0.100 (90% CI: 0.043, 0.225), CFI = 0.985, SRMR = 0.022, TLI = 0.956, $\alpha = 0.8205$

Scale: academic self-efficacy

This was one of the scales with the second-highest number of observations, at 1,508. It showed, as with both scales above, very good model fit for the expected single-factor structure, and good internal consistency ($\alpha=0.72$). Correlations with measures of attainment at GCSE also showed consistent results with those for the scales above: $r=0.15$ for Maths scores; $r=0.14$ for English Literature scores; $r=0.15$ for English Literature and/or Language scores. The relationship between this scale and number of GCSEs attained at grades 6 to 9 was weaker ($r=0.02$) but this was not unexpected. The sample for these analyses was between 213 and 567 observations respectively.

Table 37: Scale – academic self-efficacy, HEP sample

	Item	M(SD)	Factor loading
1	I am confident that I can get the grades required to progress to university.	4.14 (0.73)	0.73
2	I have the academic ability to do well at university.	4.03 (0.80)	0.61
3	I could manage with the level of study required at university.	3.98 (0.77)	0.71
N=1,508			

Model fit: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, $\alpha = 0.6234$

Scale: cognitive study strategies

The cognitive study strategies scale yielded data on 691 observations in the higher education provider sample, across both learners in higher education and learners in schools/sixth-forms/colleges.

Looking at the full sample regardless of education stage (see Table 38), the model fit was moderate to good (the RMSEA was slightly out of bounds, the other indices were all within acceptable ranges). Alternative models tested (a two-factor model) did not result in a better model fit. Splitting the sample by the stage of education (as would be the case in the implementation of the ASQ) resulted in better results for the higher education sample (40 learners) and results very similar to those in Table 38 for the non-higher education sample (651 learners). Given the evidence from all previous sets of analyses around the model fit and the fact that the internal consistency of the scale ($\alpha = 0.69$) was good given the number of items in the scale, this scale was deemed usable across the sector. The relationship between scores on this scale and measures of external attainment from GCSE were below the expected range. Across a sample of 365 learners with both measures, the correlation with Maths GCSE scores was very weak $r=0.05$, as was the relationship to the English Language/Literature scores ($r=0.09$). Similar magnitudes were observed for the relationship to the number of GCSEs attained overall, and those attained at grades 6 to 9.

Table 38: Scale - cognitive study strategies, HEP sample

	Item	M(SD)	Factor loading
1	I can find key ideas easily when reading a text for my studies.	3.84 (0.75)	0.61
2	I can assess how reliable information is when reading a text for my studies.	3.79 (0.78)	0.59
3	I can clearly explain my ideas, even when writing about complicated things.	3.70 (0.83)	0.68
4	I can confidently explain my ideas in small group discussions.	3.90 (0.83)	0.53
N=691			

RMSEA = 0.135 (90% CI: 0.098, 0.175), CFI = 0.944, SRMR = 0.041, TLI = 0.833, α = 0.6893

Scale: metacognitive strategies

The metacognitive strategies scale had data for 778 learners in higher education in the higher education provider sample. The results (see Table 39) indicate very good model fit, with very high factor loadings and high internal consistency (α = 0.87), suggesting of a robust scale for use with higher education learners. As with the cognitive study strategies scale, the relationships between scores for this scale and external attainment measures were statistically non-significant and essentially indistinguishable from zero (sample of 367). This is weaker than expected, but not sufficient evidence to ascertain that the scale did not work given the selection of the samples for this analysis and the sample size respectively.

Table 39: Scale – metacognitive strategies, HEP sample

	Item	M (SD)	Factor loading
1	I can tell when I have understood a concept or idea.	3.27 (1.51)	0.78
2	I can motivate myself to study when I need to.	3.01 (1.39)	0.71
3	I try to use ways of studying that have worked for me before	3.66 (1.46)	0.78
4	When I am done with studying, I can tell if I have learned what I wanted to learn.	3.20 (1.46)	0.81
5	I think of several ways to solve an academic problem and then choose the best way.	3.09 (1.31)	0.70
N=778			

RMSEA = 0.010 (90% CI: 0.000, 0.052), CFI = 1, SRMR = 0.009, TLI = 1, α = 0.8690

Scale: critical engagement with information

The scale with the smallest number of observations in this sample (242), the critical engagement with information scale yielded mixed results in terms of model fit, factor loadings, and internal consistency. While the model fit was relatively good (see Table 40 below), the factor loadings were all weak (some under 0.5, the only scale this was the case for in this whole set of higher education provider data analysis, and one negative despite non-negative item wording), and the internal consistency was poor (α =0.46).

Given the poor performance of the scale, its relationship to external measures was meaningless.

Table 40: Scale – critical engagement with information, HEP sample

	Item	M (SD)	Factor loading
1	I try to formulate the main points of any text I read for my studies in my own words.	3.91 (0.81)	0.43
3	When I have difficulty grasping a particular topic I am studying, I try to analyse why it is difficult for me.	3.65 (0.94)	0.37
4	I try to answer questions about the topic I am studying which I come up with myself.	3.28 (1.10)	0.54
5	I try to think up other examples and problems besides the ones given in the study materials or by the lecturer.	3.50 (0.99)	0.58
6	I try to describe the content of a paragraph in my own words.	3.13 (1.26)	-0.11
N=242			

RMSEA = 0.059 (90% CI: 0.000, 0.118), CFI = 0.937, SRMR = 0.041, TLI = 0.874, α = 0.4584

Together with evidence from previous analysis that was only occasionally suggestive of a robust scale, these results led to a decision to remove the scale from use and not include it in the ASQ.

Scale: higher education knowledge and expectations

The final scale tested with data from higher education providers related to higher education knowledge and expectations. A total of 2,349 observations were present in the data for this scale, the highest of all tested, suggesting interest from the participating providers (who were deploying the scale around their normal student access programming). As expected, given its construction, the scale did not perform well in terms of factor loadings when considered all-together. However, splitting out one item (item about intentions to apply to higher education) resulted in good model fit; and better internal consistency, although still just under the acceptable thresholds given a short three-item scale ($\alpha=0.56$).

Table 41: Scale - higher education knowledge and expectations, three-item scale, HEP sample

	Item	M (SD)	Factor loading
1	I know what studying at university would be like.	4.19 (0.85)	0.72
2	I know how studying at university is different from studying in school or at college.	3.47 (0.87)	0.63
3	I believe that if I apply to university, I will get a place.	3.92 (0.86)	0.89
4	I am thinking about applying to university in the future.	3.78 (0.83)	N/A
	N=82		

Model fit, three-item scale: RMSEA = 0.000 (90% CI: 0.000, 0.000), CFI = 1, SRMR = 0.000, TLI = 1, $\alpha = 0.56$

Given the results above, and the previous insights into the various versions of the scale, as well as consistent views from across the sector as to the importance of the scale, a decision was made to include it in the ASQ as the three-item scale in Table 41 above and a separate, stand-alone, item on higher education intentions (item 4 from Table 41).

SUMMARY OF SCALE RESULTS FROM HIGHER EDUCATION PROVIDER DATA ANALYSIS

The results of the full set of analyses outlined above suggested that in these samples, most similar to what higher education providers or other organisations in the higher education sector would use, all but two scales met expected standards and performed in the expected way. Of the remaining two scales, one did not meet expected thresholds (critical engagement with information); and for the final one (higher education expectations and knowledge) the factor analysis results suggested that a single-factor structure was not a good solution, with one item standing separately and alone from all the others (the item on higher education application intentions, as outlined in the previous analysis above). All other scales performed sufficiently well across all expected aspects and therefore were deemed appropriate for wider use.

The results upon which these conclusions were drawn are illustrated in Figure 4 below.

Figure 4: Summary of all analyses for all scales, HEP data

Scale	Clarity for respondents in cognitive testing	Internal consistency ('reliability') (Cronbach's alpha)	Split-half reliability at appropriate level (half of scale items correlated with other half)*	Split-sample reliability at appropriate level (random half of sample consistent with the other half)*	Model fit for hypothesised factor structure	Correlation with external measure(s) of hypothesised direction and magnitude	Correlation with other scales in set of hypothesised direction and magnitude
1. Belonging, prospective	almost no issues	either side of 0.7	Just over 0.5, alpha just ok for scale halves	Within 0.05	All CFA measures good	positive & small/med	Most above 0.5
2. Belonging, current	almost no issues	either side of 0.7	Over 0.6, alpha ok for scale halves	Within 0.05	All CFA measures good	positive & small/med	Most above 0.5
3. Academic self-efficacy, prospective	almost no issues	consistently above 0.7	Just below 0.6, alpha just ok for scale halves	Within 0.05	All CFA measures good	positive & small/med	Most above 0.5
4. Metacognitive strategies	some minor issues with y	consistently above 0.7	Over 0.7, alpha v high for scale halves	Within 0.05	All CFA measures good	close to 0	Most above 0.5
5. Study strategies	some minor issues with y	either side of 0.7	Just under 0.5, alpha just ok for scale halves	Within 0.05	Most CFA measures good	close to 0	Most above 0.5
6. Critical engagement with information	some minor issues with y	below 0.5	At 0.2, alpha very low for scale halves	Within 0.15	Some CFA measures under threshold	close to 0	Most above 0.5
7. Knowledge and expectations of HE	some minor issues with y	around 0.6	Just under 0.5, alpha low for scale halves	Within 0.05	Most CFA measures under threshold	close to 0	Most above 0.3 but under 0.5

Rating	Notes on data sources and approaches
Well above thresholds	The ratings above are based on analysis of the following samples:
At or just above threshold	survey #1, 386 observations (all complete), all scales with relevant groups
Just below thresholds	survey #2, 121 observations (some not complete), all scales with relevant groups
Below thresholds	survey #3, 52 observations (some not complete), all scales with relevant groups
	existing data from one organisation, 23,000+ observations, some scales
	data from HEAT from sector pilot, ~400 observations, most scales
	data from specific HEPs from sector pilot, ~3,000 observations, all scales
	data from qualitative cognitive testing with ~30 respondents, from Year 7 students to HE students.
	Not all samples had the same background characteristics measures or answers to the same items, as the scales evolved during testing.
	CFA thresholds are: CFI>0.9; RMSEA <0.08; GFI>0.9; TLI>0.9. Chi-squared not considered because samples generally large (therefore it is biased)
	*These two parameters were estimated on the final version of the scales, using the HEAT + specific HEP data (~3,500 observations across the range of scales)
	*For the split-half reliability, alpha threshold is 0.6 because alpha is biased downwards by small number of items

NEXT STEPS

The conclusion of all of these analyses, from the existing data to the data collected with support from engaged higher education providers was to retain the ASQ as inclusive of the following scales:

- Academic self-efficacy, for use with learners in schools and colleges
- Cognitive strategies, for use with learners in schools, colleges, and in higher education
- Higher education expectations (intentions to apply), a single-item for use with learners in schools and colleges.
- Knowledge of higher education, for use with learners in schools and colleges
- Sense of belonging, pre-entry, for use with learners in schools and colleges
- Metacognitive strategies, for use with learners in higher education only
- Sense of belonging, post-entry, for use with learners in higher education

Based on further feedback from the higher education providers participating in this stage of the work, and insights from the final step of the research as outlined below, different versions of the prompts for the scales were offered for use with younger learners (from Year 7/age 11 onwards) and for work relating specifically to university (as opposed to higher education more broadly).

MAKING FINAL WORDING TWEAKS AFTER FURTHER COGNITIVE TESTING

Considering the above results and further listening to the feedback provided by those who had tested the scales in their institutions, a further round of cognitive testing was undertaken specifically with younger learners. A total of six learners in Year 7 from a single school participated and offered their detailed feedback on the specific wording of scales and items relevant to access work.

APPROACH

The cognitive testing approach in this round mirrored that of the first round but provided further supportive prompts to learners (during questioning, rather than response prompts for the scales). Only scales relevant to student access work were included in the testing. Therefore, respondents each had a smaller set of scales and items to offer perspectives on, compared to the first round.

RESULTS

The six cognitive interviews resulted in the following insights:

- The prompts and response options were clear and learners understood them, as before.
- The vast majority of items were easy to comprehend, and the six participants provided very similar views on them. This again mirrors prior results from the first round of cognitive testing.
- The term “university” showed the same interpretation as before, resulting in a decision to offer multiple versions of scales that would differentiate between university and higher education and would provide an explanation of both (other evidence also supported this decision).
- Some respondents indicated confusion about the word “academically”. This led to new prompts being developed for younger learners for the scales whose items included this word, to ensure clarity and aid consistency across respondents.
- Respondents attributed different meanings to the word “information” (some differentiated between “online information” and “information from textbooks or other paper sources”); despite this, both would be relevant to a learning situation, and therefore the word was not changed.

NEXT STEPS

Learners’ views and feedback from participating institutions were then used to make very small tweaks to a small number of specific words in two of the access-relevant scales. Prompts were also reconsidered, to ensure further consistency, with a small number of clarity-enhancing edits made.

FINAL VERSION OF THE SCALES

The final version of the scales was then assembled, together with prompts and response options, and made available to the whole higher education sector.

Future work will continue to explore the performance of these scales across the sector, including in terms of their predictive validity, that is, in terms of how well they predict access, and respectively, success in higher education for the relevant populations.