

## **Validity and Reliability of Elementary Student Financial Education Outcome Measures<sup>1</sup>**

### **Introduction**

The Center for Financial Security has fielded a number of studies of financial education programs. This document describes the outcome measures the CFS has developed, generally designed to be completed by students using pen-and-paper surveys.

These outcomes are based both upon theory and empirical evidence from prior studies. Below we present the individual survey elements that compose core concepts that could be influenced by financial education and, where applicable, we present empirical evidence of validity by documenting the relationship between our scale and a previously validated set of survey measures. We also demonstrate the reliability of our measures through test-retest stability.

### **Proposed Outcome Measures**

We have organized the survey questions into several outcome categories:

- Financial Knowledge
- Budgeting
- Propensity to Plan
- Financial Self Control
- Financial Socialization
- Economic Experience

For each category, this section describes the concept and why we believe it is relevant, and lists the applicable survey questions. At the end of the section we present a table that documents the relationship between the measures and the external scales.

#### **Financial Knowledge**

Knowledge gains are one key outcome. There is no established assessment of financial knowledge appropriate for elementary students. We have developed an age-appropriate, 13-question test of general financial knowledge.

We have designed the test to be broad in scope and have not tied it to any particular financial education curriculum. There is therefore little risk of teachers “teaching to the test” and, as a result, we believe that it more accurately measures authentic student learning. Quiz questions are based on established sources such as the

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<sup>1</sup> This document was written Mike Batty, J. Michael Collins, Elizabeth Odders-White.

Council for Economic Education, the Federal Reserve financial literacy test, the Florida curriculum standards, Lusardi, Mitchell, and Cuerto (2010), and Batty, Collins, Odders-White (2015). In that light, below we show the questions that constitute the scale, as well as statistics about the performance of the scale. This could be used in future studies aiming to assess the financial knowledge of similar aged students in the future. (Five questions are adapted directly from and Batty, Collins, Odders-White, 2015, designated by \*\* ).

### **Financial Knowledge Questions:**

1. People who own things may earn money by renting them to other people.
  - **True**
  - False
  - Don't know or Not sure
2. A plan for spending your money is called a... \*\*
  - **...budget**
  - ...stock
  - ...credit
  - ...balance
  - Don't know or Not sure
3. David has to pay \$750 in rent for his apartment this month, but only has \$500 in income. What should he do?
  - Put \$250 into savings
  - **Borrow \$250**
  - Not pay his rent
  - Don't know or Not sure
4. David just found a job that pays \$2,000 per month. He must pay \$1,000 for rent and \$600 for everything else he needs. How long will it take him to save \$800?
  - 1 month
  - **2 months**
  - 3 months
  - 4 months
  - Don't know or Not sure
5. Imagine you have to pay \$2 per week to use your desk at school, but you also have the option to buy the desk for \$35 and never pay per week again. If there are 15 weeks left in the school year, is it a good idea to purchase the desk if you have \$35 you can use to buy your desk today?
  - Yes
  - **No**
  - Don't know or Not sure

6. Suppose you have \$100 in a bank account that pays an interest rate of 10% per year. How much would you have in this bank account at the end of 2 years if you leave your account alone?<sup>2</sup> \*\*

- Exactly \$102
- Exactly \$120
- Less than \$120
- **More than \$120**
- Don't know or Not sure

7. Jane sets up a lemonade stand to sell drinks at the park. She paid \$3 for sugar, \$4 for fresh lemons, and \$3 for cups. Jane made \$12 in revenue from selling lemonade. How much profit did Jane make?

- \$1
- **\$2**
- \$3
- \$4
- \$12
- Don't know or Not sure

8. The Smiths have \$750 in income, and \$800 in expenses this month. They are saving money this month. \*\*

- True
- **False**
- Don't know or Not sure

9. Tracy has \$250. She wants to buy a nice backpack for \$100 and buy a new tablet for \$200. She decided to buy a simple \$50 backpack. Tracy must have decided it was more important for her to have a nicer backpack than a tablet.

- True
- **False**
- Don't know or Not sure

10. Which is closest to the cost of one ticket to a newly released movie at a regular movie theater?

- \$1
- **\$10**
- \$50
- \$75
- \$100
- Don't know or Not sure

11. Which is closest to what one week's worth of groceries cost for a family of 4?

- \$5

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<sup>2</sup> Despite its poor performance in this test, we are retaining this item because the question has been so widely used in prior studies. A similar question in Batty, Collins, and Odders-White (2015) performed well.

- \$20
- **\$200**
- \$1,000
- \$10,000
- Don't know or Not sure

12. Ming wanted to buy a fancy notebook for school and save her money to buy a computer. Ming decided to buy a plain notebook that is less expensive so she can save more money for the computer. Ming's decision is an example of... \*\*

- ...paying interest
- ...depositing money
- **...making a tradeoff**
- ...choosing a service
- Don't know or Not sure

13. Jill had \$50 in her checking account. She made a withdrawal of \$10 and a deposit of \$20. What is Jill's balance in her checking account? \*\*

- \$10
- \$20
- \$50
- **\$60**
- **Don't know or not sure**

We used item response theory (IRT), which accounts for differences in the difficulty of individual questions, to score these quiz questions. The IRT model estimates a parameter for each of the quiz items in terms of how well a correct answer to that question predicts overall performance on the quiz. In addition, the IRT approach determines how well each question discriminates between high- and low-performing students, where performance is the latent trait the scale is attempting to measure. Table 1 shows the estimates from a three-parameter logistic IRT model (which includes difficulty, discrimination, and guessing parameters) for each question.

Table 1

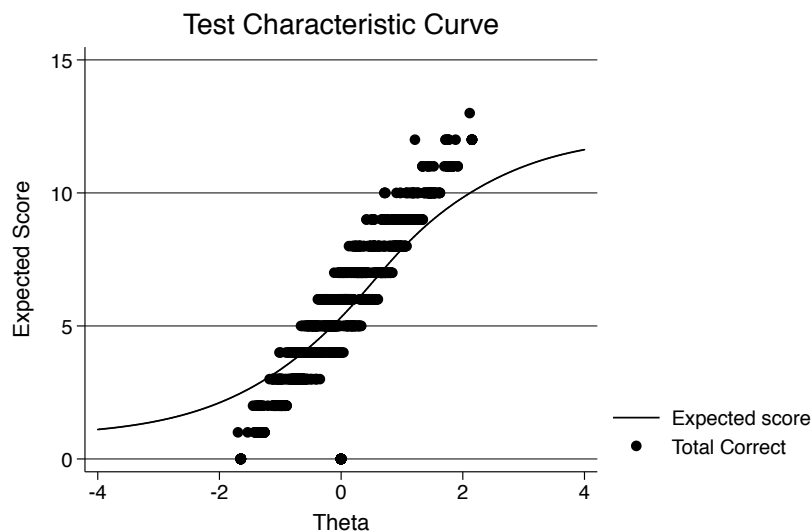
	Para Coef.	Std. Err.	z	P>z	[95% Conf Interval]	
<b>Discrim</b>						
Q1	0.7743	0.0783	9.9	0.00	0.621	0.928
Q2	0.5825	0.0683	8.5	0.00	0.449	0.716
Q3	0.8281	0.0820	10.1	0.00	0.667	0.989
Q4	1.1781	0.1111	10.6	0.00	0.960	1.396
Q5	0.9361	0.0861	10.9	0.00	0.767	1.105
Q6	-0.1425	0.0833	-1.7	0.09	-0.306	0.021
Q7	2.4674	0.3375	7.3	0.00	1.806	3.129
Q8	0.8907	0.1038	8.6	0.00	0.687	1.094
Q9	1.0442	0.0930	11.2	0.00	0.862	1.227
Q10	0.8600	0.0808	10.6	0.00	0.702	1.018
Q11	0.9165	0.0833	11.0	0.00	0.753	1.080

Q12	1.1048	0.2475	4.5	0.00	0.620	1.590
Q13	0.8063	0.0810	10.0	0.00	0.648	0.965
<b>Diff</b>						
Q1	-0.6846	0.1042	-6.6	0.00	-0.889	-0.480
Q2	-0.1893	0.1118	-1.7	0.09	-0.408	0.030
Q3	0.5964	0.0946	6.3	0.00	0.411	0.782
Q4	0.6378	0.0731	8.7	0.00	0.494	0.781
Q5	-0.0270	0.0760	-0.4	0.72	-0.176	0.122
Q6	-11.3994	6.5651	-1.7	0.08	-24.267	1.468
Q7	0.5961	0.0498	12.0	0.00	0.498	0.694
Q8	1.2850	0.1195	10.8	0.00	1.051	1.519
Q9	-0.0362	0.0709	-0.5	0.61	-0.175	0.103
Q10	-0.1079	0.0805	-1.3	0.18	-0.266	0.050
Q11	-0.2893	0.0785	-3.7	0.00	-0.443	-0.136
Q12	2.4634	0.2648	9.3	0.00	1.944	2.982
Q13	0.3596	0.0883	4.1	0.00	0.187	0.533
<b>Guess</b>	0.0435	0.0175	2.5	0.01	0.009	0.078

*n = 1,972 9-11 year olds*

Figure 1 shows the IRT modeled Expected Score (EAP) as well as the total number of correct answers. Overall the scored model is correlated with overall performance on the quiz.

Figure 1



Another characteristic of a valid metric is that students score similarly when tested at different times under similar conditions. Students were given the same survey approximately 10 weeks apart. We find that the correlation between the IRT-estimated latent financial knowledge at baseline and follow-up is 0.58. For reference, the What Works Clearinghouse aims for this type of test/re-test stability of 0.40 or greater.

### Budgeting

- How important is it to keep track of how much money you earn and spend using a budget? (1d)
- How often do you have a plan for how you will spend money? (4b)
- How good are you at making decisions about how to spend your money? (1a)
- How confident are you about making decisions that deal with money? (2e)
- How good are you at keeping track of what you spend your money on? (1b)

We have developed a series of questions about how often the students engage in financial planning behaviors. The outcome is a normalized scale of responses to these questions (5-point scale, ordered so higher scores correspond to greater financial planning).

### Propensity to Plan

- How often do you set goals for yourself? (3a)
- How often do you set goals for the next few days for what you want to achieve? (3b)
- How often do you have a plan for how your free time will be used in the next few days? (3c)
- How much better does it make you feel to have your free time planned out for the next few days? (7c)

We have developed a series of questions about how often the students engage in planning behaviors. The outcome is a normalized scale of responses to these questions (5-point scale, ordered so higher scores correspond to greater planning).

### Financial Self Control

- How hard is it for you to avoid spending any money you have right away? (1c)
- How likely are you to stop and think about something before you do it? (2d)
- How often do you ask yourself if you really need something before you buy it? (4a)
- Before making a choice, how often do you tend to think about the good things and the bad things about the choice? (6d)
- How much would you rather save money for a rainy day than spend it now on something fun? (7b)

This set of questions is designed to measure the student's self control as it relates to financial decision making. The primary outcome will be a normalized scale of responses to these questions (5-point scale, ordered so higher scores correspond to greater self control).

### Financial Socialization

- How often does your family talk about how you spend money? (4c)
- How often do you talk to your family about financial issues? (4d)

Parents are a key (and for many children the primary) influence on financial attitudes and behaviors. We believe it is beneficial for parents to begin discussing financial issues with their children at early ages. We have developed these questions to investigate the degree to which students and parents are connecting on financial issues. The outcome is a normalized scale of responses to these questions (5-point scale, ordered so higher scores correspond to more engagement with parents).

### Economic Experience

- In the last month, have you received an allowance? (21a)
- In the last month, have you gotten money from a job? (21b)
- In the last month, have you gotten money from your family for doing chores? (21c)
- Do you currently have a bank account in your own name? (21d)
- In the last month, have you received spending money or money as a gift? (21e)
- Do you make your own decisions about how to spend your money? (21f)

More experience making financial decisions is another potential influence of interventions. The variable of interest is a normalized scale of the responses to the set of yes/no questions. Note, since they measure objective outcomes the economic experience questions were not included in the test survey.

### Relationship between Outcomes and Externally Validated Scales

We utilize two externally validated scales in the Attitudes Towards Mathematics (ATM) survey (Miller et al., 1996): self-regulation and persistence. The self-regulation scale focuses on the student's ability to make and stick to a plan, and the persistence scale measures the student's grit when trying to overcome obstacles. As described in Fredricks, et al. (2011), both scales have demonstrated internal reliability and relationships with academic achievement. Further, they represent two non-cognitive skills that are often associated with success in many different arenas. The contents of the scales are shown below.

#### Self-regulation

- Before a quiz or exam, I plan out how I will study the material.
- It is easy for me to establish goals for learning in this class.
- When I study I take note of the material I have or have not mastered.
- I organize my study time well for this class.
- I have a clear idea of what I am trying to accomplish in this class.
- When I read a problem, I make sure I know what I am asked to do before I begin.
- When I finish working a problem I check my answer to see if it is reasonable.
- I try to organize an approach in my mind before I actually start problems.
- When I finished working on practice problems I check my work for errors.

## Persistence

- If I have trouble understanding a problem, I go over it again until I understand it.
- I try to complete homework assignments as fast as possible without checking my accuracy. (R)
- If I have trouble solving a problem, I'm more likely to guess at the answer than to look at examples in the book to try to figure things out. (R)
- If I have trouble solving a homework problem in the book, I copy down the answer in the back of the book if it is available. (R)
- If I have trouble solving a problem, I'll try to get someone else to solve it for me. (R)
- When I read something in the book that doesn't make sense, I skip it and hope that the teacher explains it in class. (R)
- When I run into a difficult homework problem, I keep working at it until I think I've solved it.
- When I run into a difficult homework problem, I usually give up and go on to the next problem. (R)

Table 2

	Correlation with Externally Validated Scale	
	Self-regulation	Persistence
Budgeting	0.17	0.33
Propensity to Plan	0.33	0.12
Financial Self Control	0.34	0.36
Financial Socialization	0.07	-0.24

*n = 43 9-11 year olds*

As Table 2 shows, each of the outcomes exhibits a meaningful relationship with at least one of, if not both of the external scales. This gives us further confidence that the measures communicate valuable information about student outcomes. For reference, correlation between the two externally validated scales is 0.35.

## Scale Reliability

Our goal is to organize survey questions into groups that measure core concepts. Thus, we should expect that the responses to questions within a group should be related (for the outcomes that consist of more than one survey question). Table 3 shows the estimated values. A commonly used measure of this relationship is Cronbach's Alpha scale reliability coefficient. Alpha's greater than 0.5 are generally considered acceptable.

Table 3

	Cronbach's Alpha
Budgeting	0.65
Propensity to Plan	0.68
Financial Self Control	0.68
Financial Socialization	0.35

*n = 43 9-11 year olds*



The reliability coefficients for three out of the four measures are well into the acceptable range. The fourth is a two-question measure of how much students communicate with their parents about financial issues. We are still confident using this scale because we are interested in the overall frequency with which students are speaking with their parents about any type of financial issue as opposed to how the students choose to classify those conversations.

## Reliability of Repeated Measures

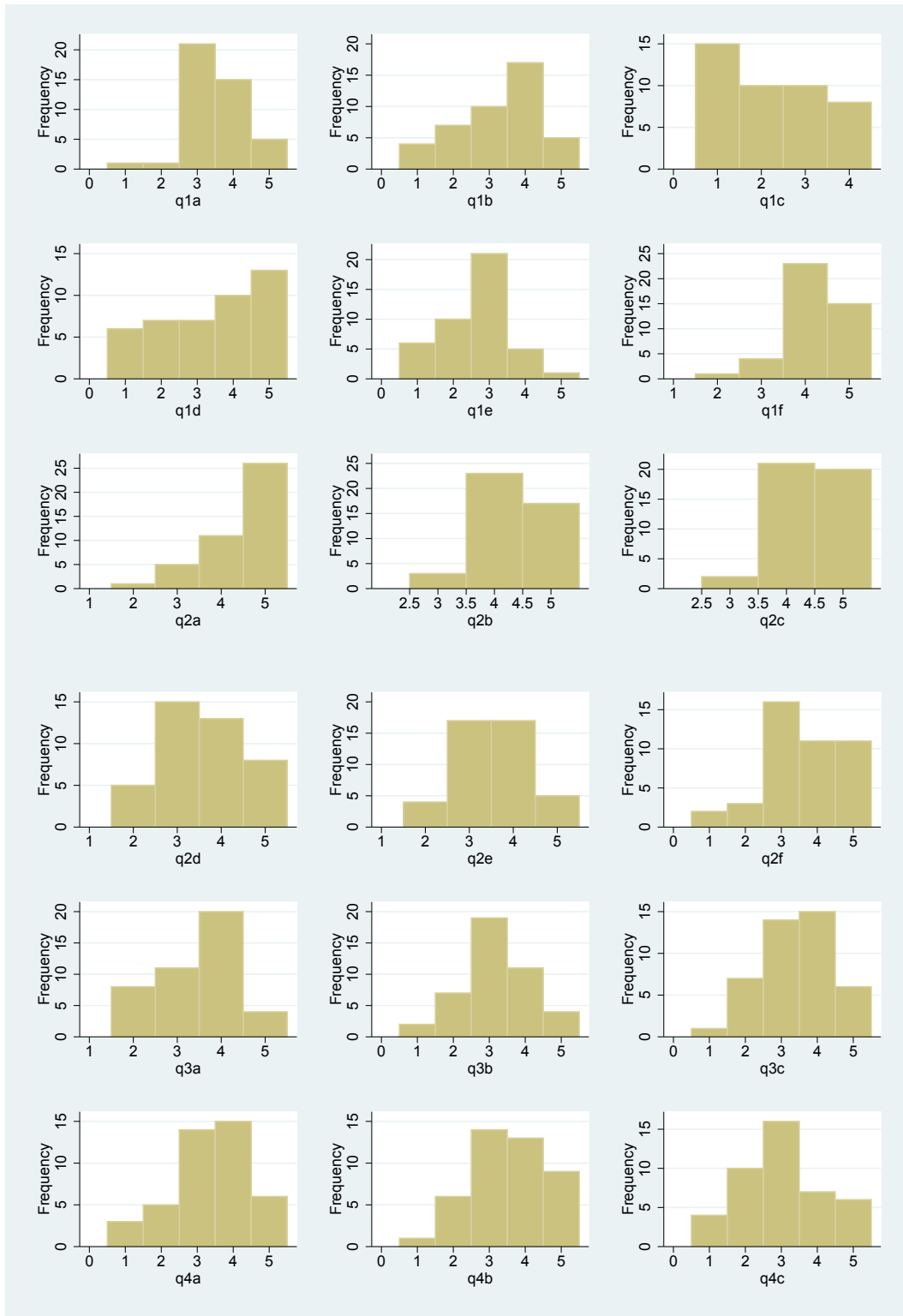
Batty, Collins, and Odders-White (2015) used several of these measures. The responses of control group students at baseline and follow-up in that study (approximately eight weeks apart) speak to the reliability of these questions. The following documents the temporal stability of student responses to the measures used in both studies. As a benchmark, the What Works Clearinghouse aims for test/re-test stability (correlation between baseline and follow-up responses) of 0.4 or greater. The table shows that even with the long time lag between the test and re-test in this study, most questions easily exceed this target. Thus, it provides evidence that the survey measures perform as expected.

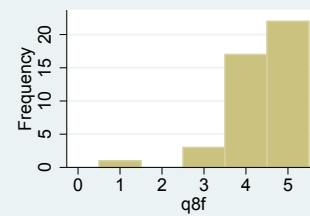
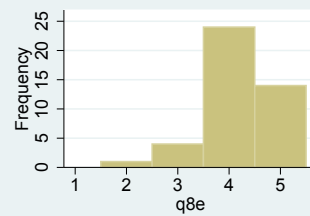
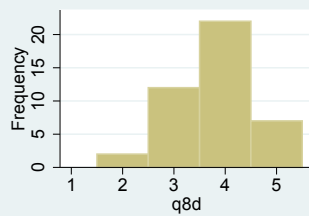
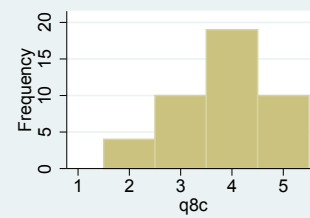
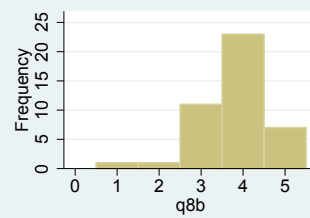
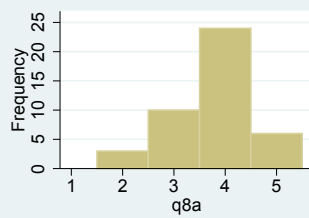
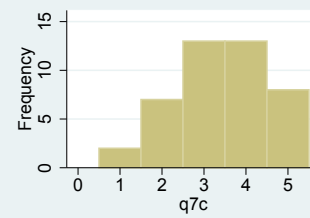
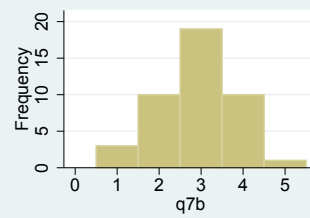
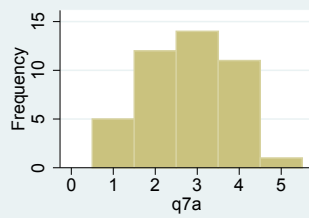
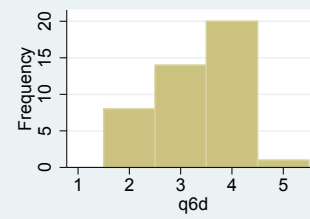
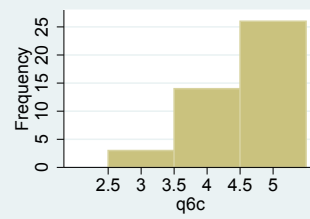
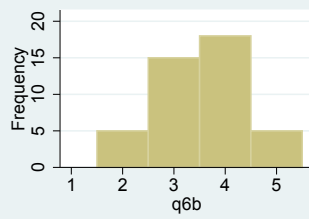
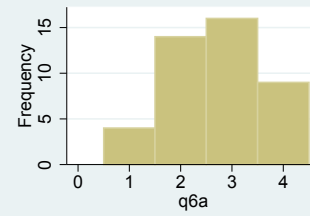
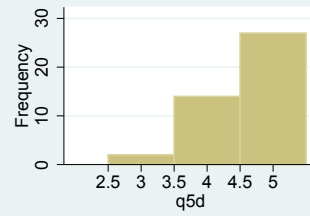
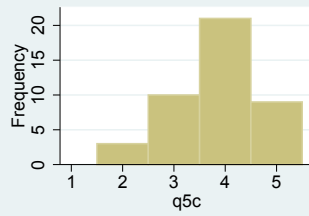
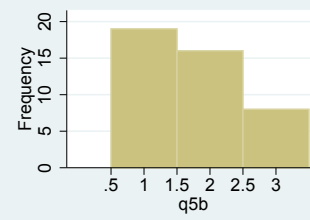
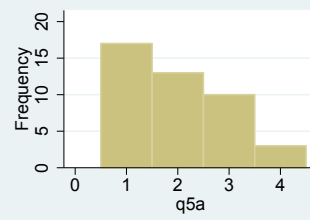
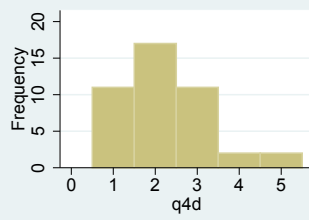
Table 4

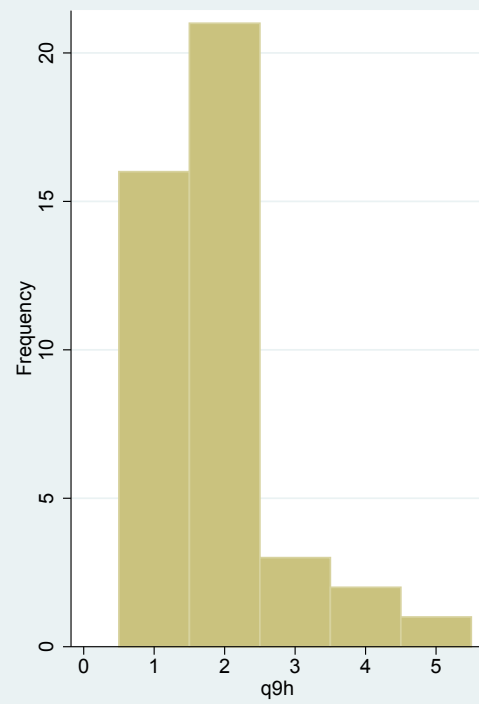
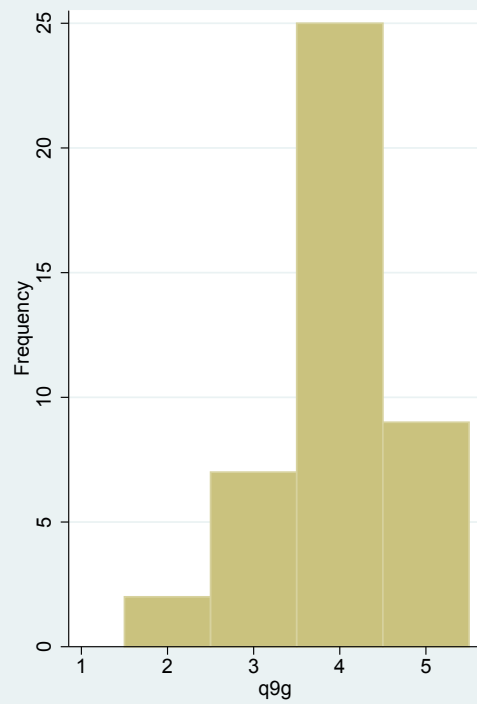
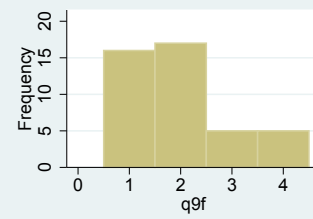
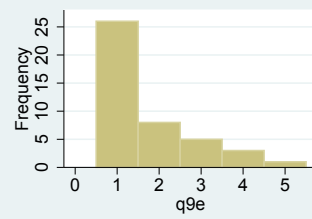
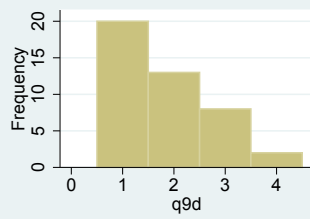
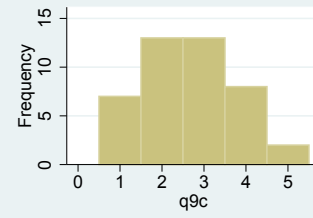
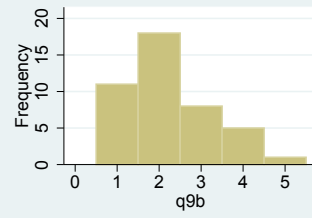
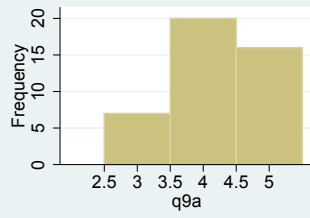
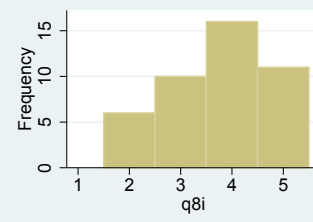
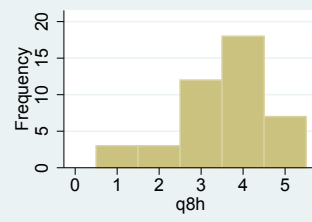
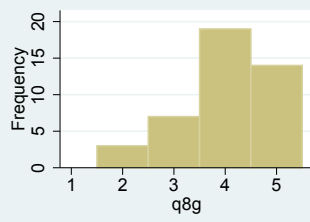
	Correlation between baseline and follow-up responses
Do you ever earn or receive money from an allowance?	0.61
Do you ever earn or receive money from a job such as a paper route or baby-sitting?	0.59
Do you ever earn or receive money from helping around the house?	0.55
How often do you find it hard to avoid spending money immediately, like within 1 or 2 days?	0.48
Is it good to save money?	0.32
Are you saving money for a specific goal, like to go to college or to buy something you want?	0.62
Doing well in school is important to me.	0.36
I expect to go to college.	0.49
Do you think banks and credit unions provide services that are useful to you?	0.39
Do you currently have a savings account at a bank or credit union in your own name?	0.69
Do you pay attention in class?	0.51
How much do you want to attend college?	0.58

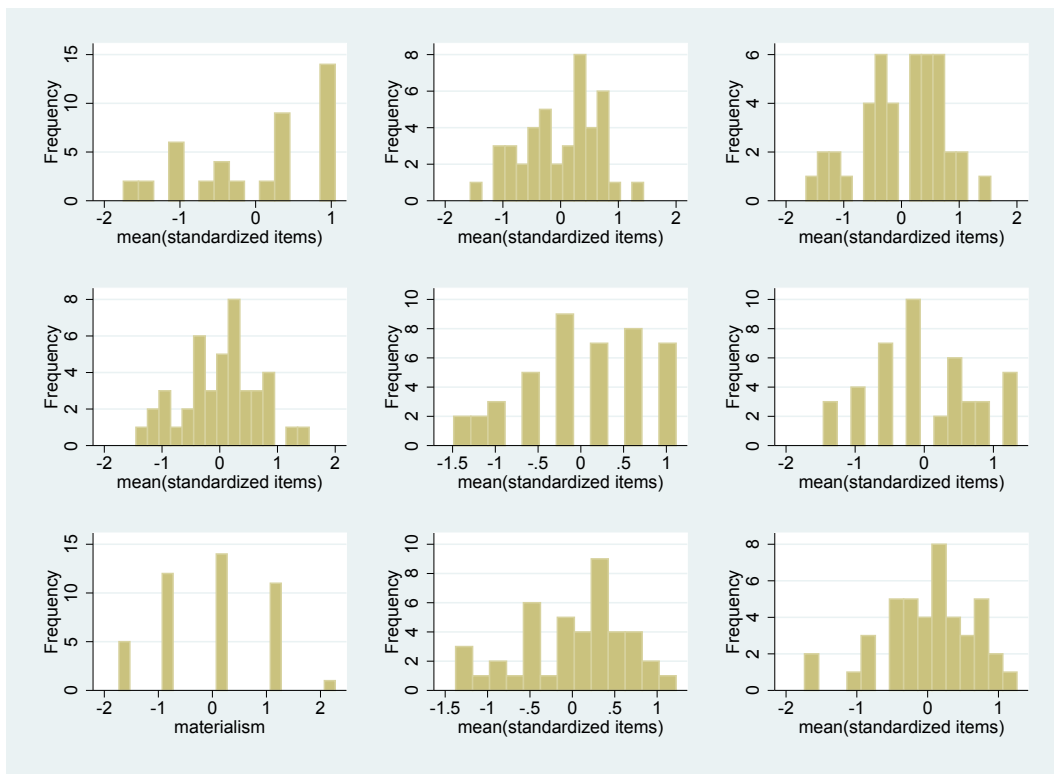
*n = 700 9-11 year olds*

## Appendix: Distributions of Responses to Questions and Scales









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