

Supplemental Material

CBE—Life Sciences Education

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Predictors of Scientific Civic Engagement Survey

Open-ended questions

Q1 Who from your school (if anyone) asked you to take this survey?

Q2 Please list the name of 1 recent science, technology, engineering or math course you have taken or are taking **with the instructor you listed above** (e.g., BIO 101).

Q3 Please list the **subject** of the recent science, technology, engineering or math class **you listed on the question above** (e.g., you might put "Biology", "Calculus" or "Engineering").

Student responses here will be piped into survey items that contains the word **SUBJECT** going forward.

Q4 A **community** is defined as *a group of people who interact and share a common sense of identity, social values, attitudes, interests, or goals (e.g., if you are a resident of New York City then you might identify with the community of "New Yorkers" and/or if you identify as Hispanic then you are a member of the Hispanic community).*"

What is **one** community with which you strongly identify? Your responses to the survey will be based on this.

Predictors of Scientific Civic Engagement scale (PSCE)

Note – Numbering of items reflect actual item numbers. Response scale is included below each question stem.

Civic self-efficacy (CE)

Q5 To what extent do you agree or disagree with the following statements?

COMPLETELY AGREE – AGREE – SOMEWHAT AGREE – SOMEWHAT DISAGREE – DISAGREE – COMPLETELY DISAGREE – I DON'T KNOW

1. I am confident that I can contribute to improving life in my community using my **SUBJECT** skills.
2. I can positively impact my community with my **SUBJECT** skills.
3. I am confident that I can apply my **SUBJECT** skills to solve real problems within my community.
4. I can make a difference in my community using my **SUBJECT** skills.

Civic action (CA)

Q6 These questions pertain to your activities **outside of formal classes**. To what extent do you agree or disagree with the following statements?

COMPLETELY AGREE – AGREE – SOMEWHAT AGREE – SOMEWHAT DISAGREE – DISAGREE – COMPLETELY DISAGREE – I DON'T KNOW

2. I often apply my **SUBJECT** skills when engaging in community service.
4. I plan to help with a community event or organization using my **SUBJECT** skills.
5. I can use my **SUBJECT** skills to help with a community event or organization.

Civic knowledge (CK)

Q7 To what extent do you agree or disagree with the following statements?

COMPLETELY AGREE – AGREE – SOMEWHAT AGREE – SOMEWHAT DISAGREE – DISAGREE – COMPLETELY DISAGREE – I DON'T KNOW

2. I know how to use my **SUBJECT** skills to help my community.
3. I can think of ways to apply my knowledge in **SUBJECT** to help my community.
5. I can think of ways to apply my **SUBJECT** skills to help my community.

Civic value (CV)

Q8 To what extent do you agree or disagree with the following statements?

COMPLETELY AGREE – AGREE – SOMEWHAT AGREE – SOMEWHAT DISAGREE – DISAGREE – COMPLETELY DISAGREE – I DON'T KNOW

5. It is important to me to find a career that provides an opportunity for me to help my community using my **SUBJECT** skills.
6. I have a responsibility to help solve my community's problems using my **SUBJECT** skills.
8. I believe that I have a responsibility to support my community using my **SUBJECT** knowledge.
9. I believe that I have a responsibility to use the knowledge that I have gained in **SUBJECT** to serve my community.

Science Self-efficacy Scale (SSE)

Q9 To what extent do you agree or disagree with the following statements?

COMPLETELY AGREE – AGREE – SOMEWHAT AGREE – SOMEWHAT DISAGREE – DISAGREE – COMPLETELY DISAGREE – I DON'T KNOW

1. I feel confident enough to ask questions in my **SUBJECT** class.
2. I believe I can do well on a **SUBJECT** test.
3. I believe I can complete all of the assignments in a **SUBJECT** course.
4. I believe I am the kind of person who is good at **SUBJECT**
5. I believe I will be able to use **SUBJECT** in my future career when needed.
6. I believe I can understand the content in a **SUBJECT** course.
7. I believe I can get an "A" when I am in a **SUBJECT** course.
8. I believe I can learn well in a **SUBJECT** course.
9. I feel confident when taking a **SUBJECT** test.
10. I believe I am the type of person who can do **SUBJECT**
11. I feel that I will be able to do well in future **SUBJECT** courses.
12. I believe I can do the **SUBJECT** in a **SUBJECT** course.
13. I believe I can think like a person who does **SUBJECT**
14. I feel confident when using **SUBJECT** outside of school.

Social Desirability Scale (SDS)

Q10 Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to you personally.

TRUE or FALSE

1. I'm always willing to admit it when I make a mistake.
2. I always try to practice what I preach.
3. I never resent being asked to return a favor.
4. I have never been irked when people expressed ideas very different from my own.
5. I have never deliberately said something that hurt someone's feelings.
6. I like to gossip at times.
7. There have been occasions when I took advantage of someone.
8. I sometimes try to get even rather than forgive and forget.
9. At times I have really insisted on having things my own way.
10. There have been occasions when I felt like smashing things.

Demographics

Q14 How do you currently describe your gender identity?

- Woman, female, or feminine
- Man, male, or masculine
- Transgender woman, female, or feminine
- Transgender man, male, or masculine
- Gender nonconforming, genderqueer, or gender questioning
- Intersex, two-spirit, or other related terms
- Other (please specify) _____
- I prefer not to answer

Q15 Which categories describe you? Select all that apply to you:

- American Indian or Alaska Native—For e.g., Navajo Nation, Blackfeet Tribe, Mayan, Aztec, Native Village of Barrow Inupiat Traditional Government, Nome Eskimo Community
- Asian—For e.g., Chinese, Filipino/a/x, Asian Indian, Vietnamese, Korean, Japanese
- Black or African American—For e.g., Jamaican, Haitian, Nigerian, Ethiopian, Somalian
- Hispanic, Latino/a/x or Spanish Origin—For e.g., Mexican or Mexican American, Puerto Rican, Cuban, Salvadoran, Dominican, Columbian
- Middle Eastern or North African—For e.g., Lebanese, Iranian, Egyptian, Syrian, Moroccan, Algerian
- Native Hawaiian or Other Pacific Islander—For e.g., Native Hawaiian, Samoan, Chamorro, Tongan, Fijian, Marshallese
- White—For e.g., German, Irish, English, Italian, Polish, French
- Some other race, ethnicity, or origin (please specify) _____
- I prefer not to answer.

Q16 Are you Mexican, Mexican-American, Chicano/a/x, Puerto Rican, Cuban, Cuban-American, or some other Spanish, Hispanic, or Latino/a/x group? Select all that apply to you.

- Mexican
- Mexican - American
- Chicano/a/x
- Puerto Rican
- Cuban
- Cuban - American
- Other (please specify) _____
- I prefer not to answer

Q17 What is your age in years?

- Please specify _____
- I prefer not to answer

Q16 What is your year in school?

- 1st year (freshmen)
- 2nd year (sophomore)
- 3rd year (junior)
- 4th year (senior)
- 5+ years
- I prefer not to answer.

Eliminated items from original PSCE scale:

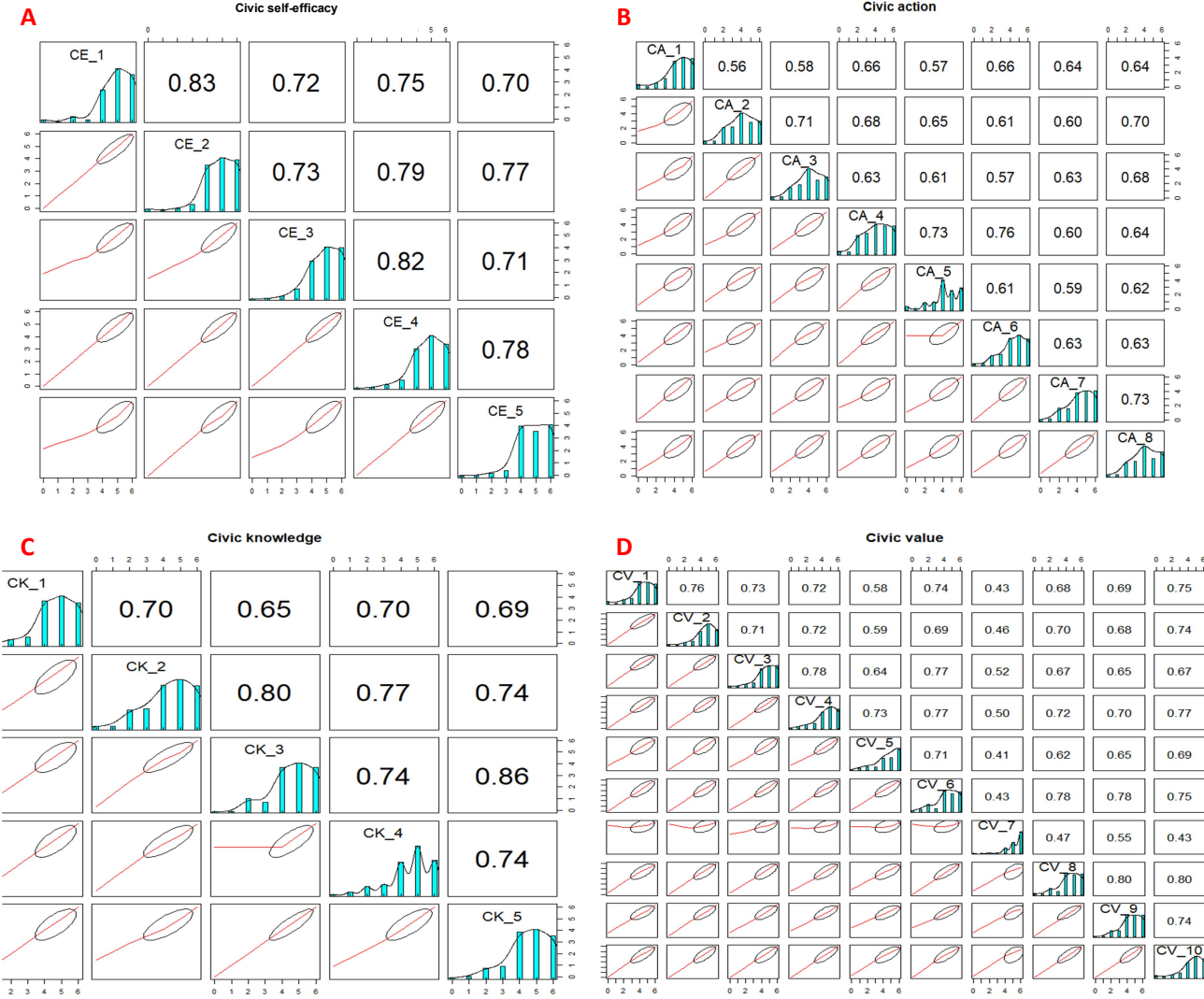
construct_Item#	Description (Red – eliminated through EFA. Blue – eliminated through CFA.)	Reason for elimination
CE_5	I have SUBJECT skills that would help my community.	Not measuring self-efficacy but rather knowledge
CA_1	I expect to be involved in improving my community by using my SUBJECT skills.	Redundant with CA_2 since the intention of community service is the improvement of one's community and the helping of community members
CA_3	I help members of my community by using my SUBJECT skills.	
CA_6	I intend to help my community with a specific issue or problem by using my SUBJECT skills.	
CA_7	I use my SUBJECT skills to participate in conversations regarding my community's issues.	Might not contribute to the scale because there are times at which a person may use their subject skills to participate and other times at which they may not. The item may present a false dichotomy by stating simply "I use my subject skills to participate," thus it made sense to remove this item.
CA_8	I use my SUBJECT skills when I offer my time/effort to help my community.	Presented two potential options (time and effort) which is not best practice in psychometrics.
CK_1	I can find ways to help my community using my SUBJECT skills.	Redundant with the other questions and eliminated it due to the slight difference in wording (i.e., can find instead of "think" or "know) which had a poor fit.
CK_4	I recognize which of my SUBJECT skills would be valuable for my community.	Asking a question that involves a value judgement of what would be valuable for others was inappropriate and thus this question didn't contribute to the construct.

construct_Item#	Description (Red – eliminated through EFA. Blue – eliminated through CFA.)	Reason for elimination
CV_1	I find it important to find time to contribute to my community using my SUBJECT skills.	Redundant with CV_5
CV_2	I find it important to improve my community using my SUBJECT skills.	Redundant with CV_6 and CV_9
CV_3	I believe I should make a difference in my community using my SUBJECT skills.	
CV_4	Making a difference in my community using my SUBJECT skills is something that I value.	
CV_7	I believe that it is important to be informed of community issues.	Didn't contribute to the construct since being informed does not relate to intentions to improve one's community. Also, not specific enough with issues.
CV_10	My SUBJECT skills are valuable to help solve my community's problems.	Didn't relate to the construct because it is a judgement of one's skills not one's value for the actions done.

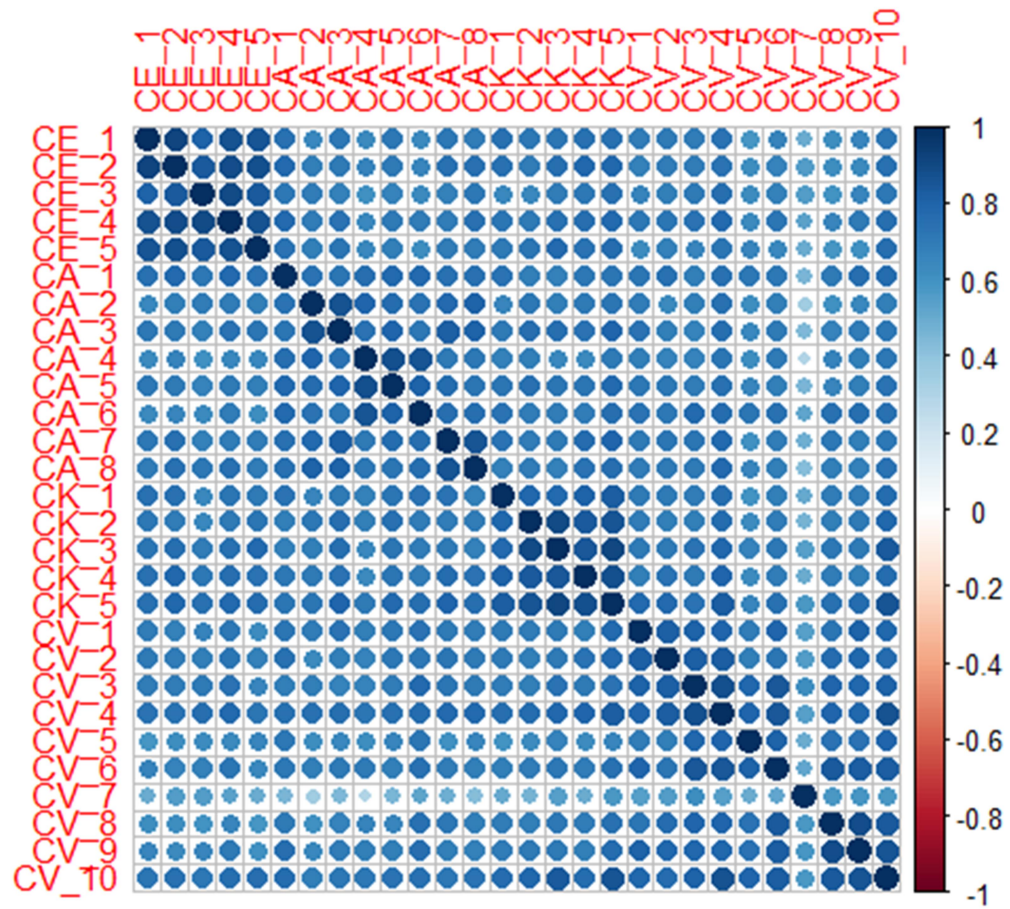
Cognitive interview findings

CA_6, "I intend to help my community with a specific issue or problem using my biology skills," had interpretation issues among three respondents. While one student interpreted the word "intend" as needing to have a "concrete plan" to help the community, another student felt "intend" appeared "lax" in nature. The third respondent was distracted by the word "specific" and said they would "STRONGLY DISAGREE" to CA_6 because the specific issue they had in mind did not require biology so interpreting biology skills in this context seemed "vague" to them. Three respondents were not in favor of CV_1, "I find it important to find time to contribute to my community using my biology skills." One student found it "wordy," and another compared the time aspect of this item with CV_2 ("I find it important to improve my community using my SUBJECT skills." ; also eliminated), the former being "more of a personal sacrifice" and "personally involved" than the latter. Additionally, another respondent took a different approach instead of focusing on their biology skills when responding to this item. This respondent chose to disagree because "[they] know [finding time to contribute] is important, but (they) don't do it. So, it must not be that important to (them). Otherwise, (they) would do it." Their response was influenced by the value aspect only and they did not make a connection between civic value and their [science] skills. Lastly, CV_7 ("I believe that it is important to be informed of community issues"), which had the poorest fit, was also biased as pointed out by one student who said, "it would be weird if you strongly disagree" and another who strongly agreed because they "got to know what's going on".

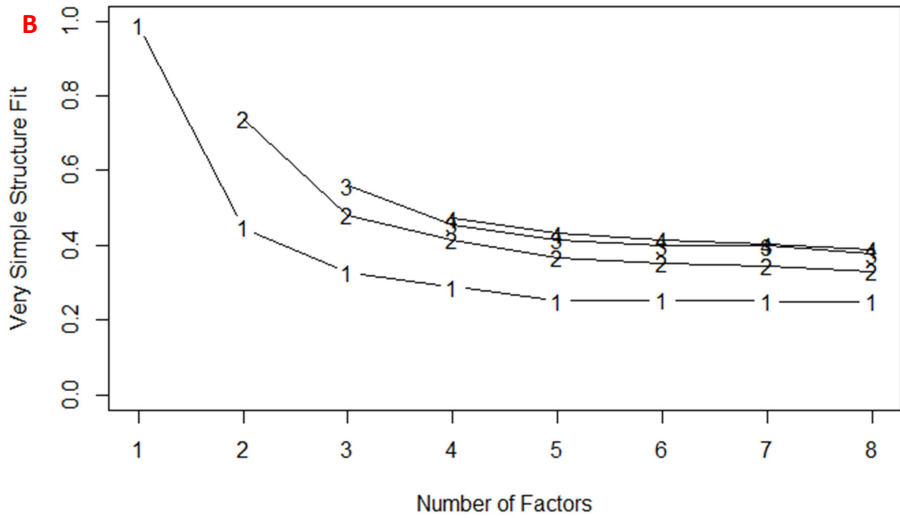
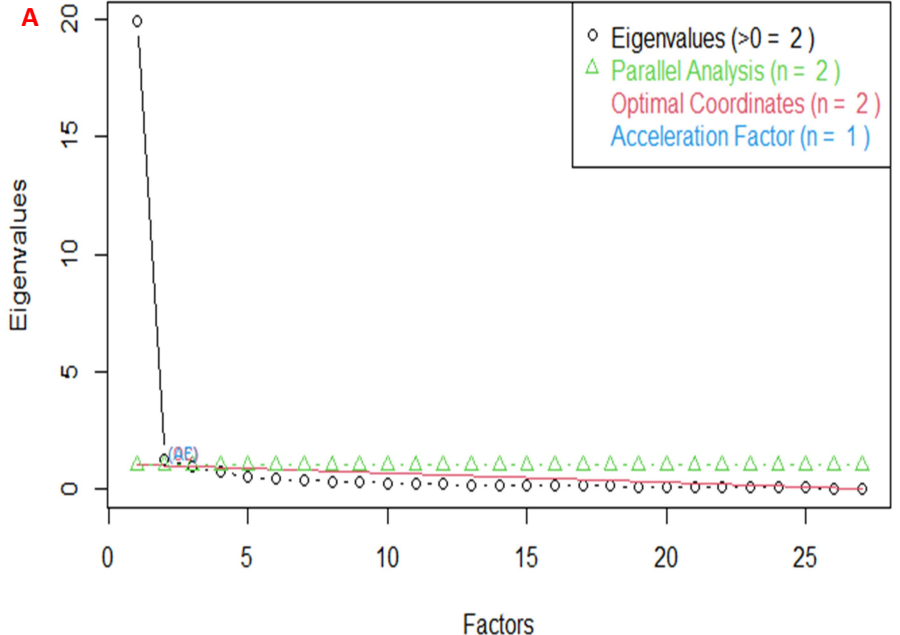
Supplementary Figures and Tables



S Figure 1 (A-D). Data distributions of EFA responses for each scale (N = 259)



S Figure 2. Inter-item polychoric correlation matrix.



S Figure 3A & B. Kaiser criterion and Parallel Analysis plot (A) and Very Simple Structure plot (B) for EFA.

		CV	CE	CA	CK
Factor correlations	CV				
	CE	0.6			
	CA	0.7	0.6		
	CK	0.6	0.6	0.7	

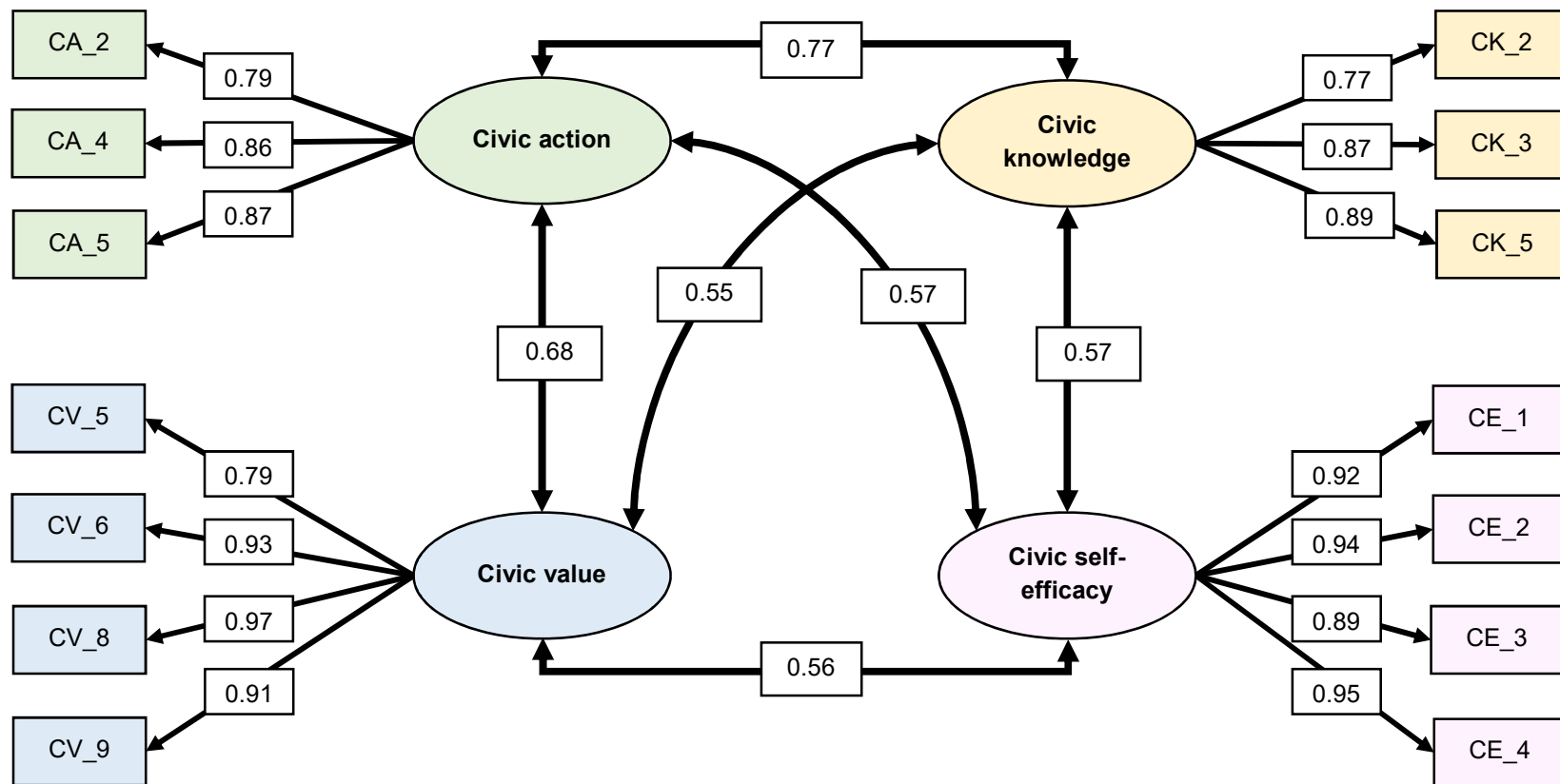
S Table 1. 4- factor EFA factors

lhs	op	rhs	mi	epc
knowledge	=~	CV_3	114.6	0.3047
action	=~	CV_3	107.8	0.3684
efficacy	=~	CV_3	75.18	0.2171
knowledge	=~	CE_5	44.88	0.1703
action	=~	CE_5	35.75	0.1465
CA_2	~~	CK_2	31.94	0.1436
knowledge	=~	CA_4	30.33	-0.3573

S Table 2. CFA modification

	CE_1	CE_2	CE_3	CE_4	CE_5	CA_2	CA_4	CA_5	CK_2	CK_3	CK_5	CV_3	CV_5	CV_6	CV_8	CV_9
CE_1																
CE_2	0.03															
CE_3	0.00	-0.02														
CE_4	-0.02	0.00	0.02													
CE_5	-0.03	-0.03	0.00	-0.01												
CA_2	-0.04	-0.03	-0.01	-0.02	0.05											
CA_4	-0.04	-0.04	-0.03	-0.01	0.00	-0.02										
CA_5	0.00	-0.01	0.02	0.05	0.06	-0.01	0.01									
CK_2	-0.02	-0.05	-0.04	-0.03	0.06	0.11	-0.04	0.01								
CK_3	-0.03	-0.03	-0.04	-0.04	0.04	0.03	-0.07	-0.03	0.03							
CK_5	0.01	0.00	0.03	0.01	0.10	0.02	-0.05	-0.01	-0.05	0.00						
CV_3	0.03	0.07	0.04	0.07	0.06	0.01	0.10	0.06	0.05	0.10	0.11					
CV_5	0.02	0.02	-0.01	0.01	0.01	-0.06	0.01	-0.07	-0.06	-0.04	0.00	-0.02				
CV_6	-0.02	-0.02	-0.05	0.00	0.01	-0.04	0.02	-0.04	-0.03	-0.05	0.00	-0.07	0.04			
CV_8	-0.03	-0.04	-0.07	-0.03	0.00	-0.07	0.03	-0.08	-0.04	-0.02	0.01	-0.07	0.01	0.01		
CV_9	-0.03	-0.03	-0.05	0.01	0.02	-0.02	0.05	-0.02	-0.03	-0.03	-0.02	-0.04	0.00	0.00	0.01	

S Table 3. CFA residual correlation matrix.



S Figure 4. Final CFA model.