Supplemental Material

CBE—Life Sciences Education

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CFA Methods for Coping Skills

While the framework underlying the COPE and Brief COPE instruments are well understood and articulated, we only wanted to use a subset of the scales, and we also incorporated questions from both the COPE (the original instrument) and the Brief COPE (the revised shorter instrument) in our study. Thus, we wanted to confirm the factor structure for our population, especially regarding whether the Active Coping and Planning items loaded onto the same factor for our study population as they did in Carver (1997). In addition, unlike the anxiety and instructor immediacy measures presented above, the dimensionality of the Brief COPE had not been explored for undergraduates, and we wanted to ensure that we were using the best possible model fit to interpret our data. Thus, we ran two CFAs to compare four and five factor measurement models using these items (n=154). CFAs were run using the R package lavaan (Rosseel, 2012). Maximum-likelihood estimation (ML) was used to extract the variances from the data. There was no missing data in the dataset used for our CFAs.

We ran CFAs specifying both four and five factor solutions. The four-factor model included 1) Avoidance/Behavioral Disengagement (*items 1-5*), 2) Active and Planning (*items 6-9*), Instrumental Support Seeking (*items 10-11*), and Self-blame (*items 12-13*). The five-factor model included 1) Avoidance/Behavioral Disengagement (*items 1-5*), 2) Active Coping (*items 6-7*), 3) Planning (*items 8-9*), 4) Instrumental Support Seeking (*items 10-11*), and Self-blame (*items 12-13*) (see Supplementary Materials for specific items). Multiple fit indices (comparative fit index [CFI]; the root-mean-square error of approximation [RMSEA]; and the standardized root-mean-square residual [SRMR]; akaike information criterion [AIC]) were consulted to evaluate model fit. The five-factor model that loaded Active Coping and Planning items onto different factors had better scores for each fit index than the four-factor model that combined those items onto one factor. We also ran an ANOVA comparing the four- and five-factor models to attain more evidence of whether one was a statistically better fit for our data. Consistent with the recommendations by Schermelleh-Engel, Moosbrugger, and Müller (2003), the following criteria was used to evaluate the adequacy of the models; $CFI > .90$, $SRMR < .10$, and $RMSEA < .08$ were considered adequate and $CFI > .95$, $SRMR < .05$, and $RMSEA < .05$ were considered good fit.

We found that the five-factor model was supported by our data, and that it performed better than the four-factor model as tested by an ANOVA ($p < 0.001$). Our five-factor model also performed better for each index of fit ($CFI = 0.936$, $SRMR = 0.07$, $RMSEA = 0.085$, $AIC = 4172.863$) than the four-factor model ($CFI = 0.925$, $SRMR = 0.08$, $RMSEA = 0.09$, $AIC = 4180.170$). Factor loadings were computed based on the model results and used to assess reliability of each factor. All factor loadings were > 0.7 with the exception of four items (4, 9, 10 and 12) that were all > 0.55, which account for sufficient variance to be included. Removal of items 9, 10 and 12 would have resulted in only one item for each of their three associated subscales, so we did not remove those items. Our RMSEA value falls slightly outside of our limits for adequate fit, however recent work has highlighted that maximum-likelihood estimation is more conservative than other estimators when used with ordered categorical data (like ours) and may result in slightly higher estimates of RMSEA (Xia and Yang, 2018). Therefore, we feel justified in its use for our sample population because again, the theoretical framework underlying this instrument is well understood and articulated for study populations very similar to ours. We proceeded in our analysis with the five-factor model.

A - Demographic Questions

- Age (open-ended)
- Gender (open-ended)
- Race (open-ended)
- Are you a first-generation college student? (Yes/No)
- Are you a non-traditional student? (Yes/No)
- Do you have a learning disability? (Yes/Yes but not currently registered with university/No)

B - Revised Non-Verbal Immediacy Measure

Below are a series of descriptions of things some teachers have been observed doing in some classes. Please respond to the statements in terms of how well they apply to your TA.

1-Never   2-Rarely   3-Occassionally   4-Often   5-Very Often

- Gestures while talking to the class
- Uses monotone/dull voice when talking to the class*
- Looks at the class while talking
- Smiles at the class while talking
- Has a very tense body position while talking to the class*
- Moves around the classroom while teaching
- Looks at the board or notes while talking to the class*
- Has a very relaxed body position while talking to the class
- Smiles at individual students in the class
- Uses a variety of vocal expressions when talking to the class

*Reflected when scoring

C-Verbal Immediacy

Below are a series of descriptions of things some teachers have been observed doing in some classes. Please respond to the statements in terms of how well they apply to your TA.

1-Never   2-Rarely   3-Occassionally   4-Often   5-Very Often

- Uses personal examples or talks about experiences they have had outside of class
- Asks questions or encourages students to talk
- Gets into discussions based on something a student brings up even when this doesn't seem to be part of their lecture plan
- Uses humor in class
- Addresses students by name
- Addresses me by name
- Gets into conversations with me before, after or outside of class
- Has initiated conversations with me before, after or outside of class
- Refers to the class as "my" class or what "I" am doing*
- Refers to the class as "our" class or what "we" are doing

- Provides feedback on my individual work through comments on papers, oral discussions, etc.
- Calls on students to answer questions even if they have not indicated that they want to talk*
- Asks how students feel about an assignment, due date or discussion topic
- Invites students to email or meet with them outside of class if they have questions or want to discuss something
- Asks questions that have specific, correct answers*
- Asks questions that solicit viewpoints or opinions
- Praises students' work, actions or comments
- Criticizes or points out faults in students' work, actions or comments*
- Will have discussions about things unrelated to class with individual students or with the class as a whole
- Is addressed by their first name by the students

*Reflected when scoring

D - Gaining Initial Skills in R Anxiety (excluded in semester 3)

The items in this questionnaire refer to things and experiences related to R that may cause anxiety or apprehension. Please indicate the EXTENT to which each of the following situations described below would make you anxious at this point in your life.

1-Not at all   2-A little   3-A fair amount   4-Much   5-Very much

- Taking a test on R competence
- Working in a job that requires R competence
- Getting "error" messages from R
- Teaching someone else about R
- Dealing with R malfunctions/errors
- Being evaluated on my R competence
- Learning about R without structured guidance
- Using R to conduct statistical analyses
- Interpreting results from R
- Presenting work I've done in R
- Being taught how to use R by a peer
- Getting feedback from my teacher on my R skills
- Getting feedback from my peers on my R skills
- Collaborating with a friend while learning to use R
- Getting feedback on my R skills
- Taking a course in R
- Learning R terminology
- Reading a guide to using R
- Learning how R works
- Learning a new analysis in R

E - Sense of Control in R

Please indicate how often you have the following thoughts when you use R or think about using R.

1-Not at all   2-A little   3-A fair amount   4-Much   5-Very much

- I feel in control of what I do
- I will be able to get R to do what I want
- I will understand what to do
- I know I can do it
- I feel confident about my ability with R
- I can master R
- I look forward to using R in my job/at college
- It scares me to think that I could cause R to destroy a large amount of data by hitting the wrong key*
- I hesitate to use R for fear of making mistakes that I cannot correct*
- In class everyone else but me knows what they are doing*
- People will notice if I make a mistake*
- I'm afraid I'll wreck the program*
- What if I hit the wrong key?*
- I'm too embarrassed to ask for help*

*Reflected when scoring

F - R Self Concept

Using the following scale please indicate how much you agree or disagree with the following propositions.

1-Strongly disagree   2-Disagree   3-Unsure   4-Agree   5-Strongly agree

- I am very confident when it comes to working in R
- I can get a good grade in courses that use R
- I am confident conducting analyses in R
- I am sure I could solve any problems that I had while I was using R
- I can help others solve problems in R
- I am sure that I can help others learn to use R
- The challenge of learning to use R is exciting
- Anyone can learn to use R if they are patient and motivated
- Learning to use R is like learning any new skill – the more you practice, the better you become
- I am sure that with time and practice I will become comfortable with R
- I feel that I will be able to keep up with the advances happening in R
- I feel that R is a necessary tool in my field
- I am no good with R*
- I feel apprehensive/weary about using R*
- I don't think I would be able to learn a new statistical analysis in R*
- I dislike working in R*

- I have difficulty working in understanding the language used in R*
- I am not the type to do well with R*
- I think using R would be very hard for me*
- You have to be a genius to understand all the code and results from R*
- I don't think I will/could handle a course that uses R*
- I avoid using R as much as possible because it is unfamiliar and somewhat intimidating to me*

*Items reflected upon scoring

G - State of Anxiety in R Situations

Using the following scale indicate how often you have the following feelings or symptoms when you use R, think about using R or have to write code in R.

1-Almost never   2-Sometimes   3-Often   4-Almost always

- I feel anxious whenever I use R
- I wish I could be as calm as others appear to be when they are using R
- I feel tense whenever I work in R
- I experience anxiety whenever I sit in front of R
- Feelings of unease
- Worries about possible problems
- I feel threatened/insecure
- I feel nervous
- I feel overwhelmed
- I feel helpless when I use R
- I feel rattled when I use R
- I feel content when I'm working in R
- I feel relaxed when I use R
- I feel comfortable with R
- I feel at ease with R
- Nervous stomach, "butterflies"
- Hot and sweaty
- Heart palpitations
- Dry mouth
- Sweaty palms
- Lack of concentration
- Distractible

H - Avoidance/Behavioral Disengagement

How often do you do the following when you encounter an issue with R?

1-Not at all   2-Rarely   3-Occassionally   4-A lot

- I give up trying to deal with it

- I reduce the amount of effort I put into solving the problem
- I give up trying to reach my goal
- I avoid classes that use R
- I give up the attempt to cope with the problem

I - Active Coping

How often do you do the following when you encounter an issue with R?

1-Not at all   2-Rarely   3-Occassionally   4-A lot

- I concentrate my efforts on solving the problem
- I take action to try to make the situation better

J - Planning

How often do you do the following when you encounter an issue with R?

1-Not at all   2-Rarely   3-Occassionally   4-A lot

- I try to come up with a strategy about what to do
- I think hard about what steps to take

K - Instrumental Support Seeking

How often do you do the following when you encounter an issue with R?

1-Not at all   2-Rarely   3-Occassionally   4-A lot

- I get help and advice from my instructor
- I try to get advice or help from other people about what to do

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L - Self-Blame

How often do you do the following when you encounter an issue with R?

1-Not at all   2-Rarely   3-Occassionally   4-A lot

- I criticize myself
- I blame myself for not understanding R