Development of an Instrument to Measure Student Use of Academic Success Skills: An Exploratory Factor Analysis

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Abstract

This article describes the development of the Student Engagement in School Success Skills instrument including item development and exploratory factor analysis. The instrument was developed to measure student use of the skills and strategies identified as most critical for long-term school success that are typically taught by school counselors.

Keywords

achievement, assessment of achievement, school counseling, counseling, exploratory factor analysis

Academic success skills are prerequisites to content learning. These critical skills and strategies have been consistently identified over several decades in large reviews of educational research literature (Hattie, Biggs, & Purdie, 1996; Masten & Coatsworth, 1998; Wang, Haertel, & Walberg, 1994). A common thread appearing in each of these large reviews is the importance of three critical skills sets known to contribute to student academic success and social competence: (a) cognitive and metacognitive skills such as goal setting, progress monitoring, and memory skills; (b) social skills such as interpersonal skills, social problem solving, listening, and teamwork skills; and (c) self-management skills such as managing attention, motivation, and anger. More recently, researchers have provided support for those skills known to separate successful students from students at risk of academic failure (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2010; Greenberg et al., 2003; Marzano, Pickering, & Pollock, 2001; Zins, Weissberg, Wang, & Walberg, 2004). The American School Counselor Association [ASCA] national model (ASCA, 2012) with its three programmatic pillars of academic, personal/social, and career align closely with these three skill sets. However, there have been limited standardized measures that tie outcomes directly related to school counselor interventions to academic and social success (Brown & Trusty, 2005).

In the current age of accountability, linking school counseling programs and interventions to improved students outcomes has become increasingly important. The ASCA's (2005) response to these accountability demands reflects the U.S. Department of Education's (2010) call for more research on what is

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needed to improve student achievement. In 2005, a Delphi study was conducted by leaders in the field of school counseling to identify the most pressing research questions in the profession. The top priority cited by the Delphi study was the need to determine which school counseling interventions resulted in the greatest gains in student achievement (Dimmitt, Carey, McGannon, & Henningson, 2005). Several of the remaining top 10 research questions in the Delphi study also reflected the need for more research on the impact of school counselor interventions on academic achievement and behavior related to school success. In addition, five major reviews of school counseling research have all pointed to the need for more research to strengthen the link between school counselors and student achievement (Brown & Trusty, 2005; Dimmitt, Carey, & Hatch, 2007; Whiston & Quinby, 2009; Whiston & Sexton, 1998).

With growing pressure for schools to show student improvement on standardized achievement measures, many school counselors are finding it increasingly difficult to implement comprehensive school counseling programs that follow guidelines set by the ASCA national model (ASCA, 2012). This difficulty is due in large part to the growing demand for more direct instruction in academic content areas in the classroom (U.S. Department of Education, 2010), creating a quandary for school counselors. Unless school counselors can demonstrate the impact of classroom guidance and small group counseling on achievement through intermediate variables associated with achievement, school counselors will find themselves more marginalized and less able to directly influence student success through their comprehensive programs. These intermediate variables include the previously mentioned skills involving cognitive, social, and self-management skill sets.

While it is essential that school counselors assess the impact of their programs, instruments that measure the critically important skills sets are limited. Brown and Trusty's (2005) review of school counseling research concluded that one of the limitations of school counseling research has been the lack of valid and reliable instruments that measure the skills, strategies, and personal attributes associated with academic and social/relationship success. The Student Engagement in School Success Skills (SESSS) instrument was developed to measure student use of the skills and strategies identified as most critical for long-term school success that are typically taught by school counselors. The authors have developed 33 items for the SESSS instrument based on the skills, strategies, and attributes identified in the previously cited comprehensive reviews.

While a few instruments helpful to school counseling accountability have recently been developed (Scarborough, 2005; Sink & Spencer, 2007; Whiston & Aricak, 2008), these instruments do not actually measure student-level changes in knowledge and skills related to academic achievement. There is still a need for empirically based instruments that measure student usage of the types of skills and strategies that have been identified as being related to achievement and potentially sensitive to school counseling interventions. Previous research on self-report measures of student's metacognition indicates that it is feasible to develop such a measure for elementary level students (Sperling, Howard, Miller, & Murphy, 2002; Yildiz, Akpinar, Tatar, & Ergin, 2009). The present article describes the development of the SESSS instrument including item development and an exploratory factor analysis.

Method

Initial Scale Development

The SESSS was developed to measure the extent to which students use the specific strategies introduced during Student Success Skills (SSS) classroom lessons (Brigman & Webb, 2010). Personnel at the Ronald H. Fredrickson Center for School Counseling Outcome Research and Evaluation, with iterative feedback from the curriculum developers, drafted an initial set of survey items reflecting students' cognitive engagement of skills and

strategies included in the SSS curriculum (e.g., "When I am working on something that is difficult, I try to pay attention to the small improvements that I am making and remind myself that I'm getting better."). A readability analysis of items was conducted using the Lexile Framework for Reading system (MetaMetrics, Inc., 2012) to ensure that the complexity of the text matched the reading ability of a typical fifth-grade student. In these analyses, no item exceeded a fourth-grade reading level. In addition, an expert panel composed of two elementary teachers and two school counselors reviewed the survey items. This panel represented different geographic areas in the country and worked in school districts with students from diverse racial, ethnic, and socioeconomic backgrounds. After the independent review, a pilot version of the instrument was administered to two classrooms of fifth-grade students. The only recommendation of the expert panel and classroom students was to change a few of the vocabulary words in survey items as their meaning might not be clearly understood by typical fifth-grade students. Based on feedback received, minor changes were made to improve clarity on several items.

Twenty-seven self-report items were assembled into a scale with the following directions:

> Below is a list of things that some students do to help themselves do better in school. No one does all these things. No one does any of these things all the time. Please think back over the last 2 weeks and indicate how often you did each of these things in the last 2 weeks. Please follow along as each statement is read and circle the answer that indicates what you really did. Please do your best to be as accurate as possible. There are no right or wrong answers. We will not share your answers with your parents or teachers. We will not grade your answers.

The response format included four options that reflected frequency of strategy use in the last two weeks: "I didn't do this at all," "I did this once," "I did this two times," "I did this three or more times." This format was not conducive to writing clear negatively stated items. Therefore, six additional items were developed to help control for response set; three of these items reflected strategies that elementary students were unlikely to use (e.g., searching the internet for additional math problems to work on) and three items reflected strategies that elementary students were likely to use (e.g., asking a friend when homework was due) but were not covered in the SSS program.

The trial instrument was administered to a diverse group of 262 elementary students in the fourth through eighth grades. The overall alpha coefficient for reliability for the 27-item scale was found to be .91. Coefficient alphas for each grade ranged between .87 (for fifth grade) and .95 (for seventh grade). All items correlated well with the total scale (ranging between .34 and .63). Scores on the total scale were found to be distributed approximately normally with a mean of 65.83 and a standard deviation of 15.44.

Sample

Professional school counselors from two university laboratory research schools in two different school districts administered the SESSS instrument to students enrolled in Grades 4 to 8 during the 2009–2010 academic school year. The two university laboratory research schools serve students in kindergarten through eighth grade. Admission to the schools is based on a lottery system for students aged 5 and older. Each school is required to maintain a statewide racial and economic demographically representative student population rather than enrollment being based on neighborhood residence. Newly admitted students entering grades K–8 are selected annually from a pool of applicants and the lottery is run until all demographic groups are appropriately represented. Six hundred and forty-six students attended school one with the following demographic profile: 51.1% White, 21.8% Black, 17.3% Hispanic, 4.6% Asian, 1.5% Native American, 3.6% Multiracial, 9.3% Disabled, 27.1% Economically disadvantaged, and 1.5% English language learners (ELL). The second school's demographic profile consisted of 1,470 students including 52.8% White,

20.8% Black, 20.2% Hispanic, 1.8% Asian, 0% Native American, 4.4% Multiracial, 10.6% Disabled, 49.5% Economically disadvantaged, and 2.8% ELL. Specific demographic information from the students who completed the SESSS instrument was not collected.

During the fall of 2009, a sample of students in Grades 4 to 6 at one of the university laboratory research schools completed the SESSS instrument. In the spring of 2010, all students in Grade 7 and a sample of students in Grade 8 at the second university laboratory research school completed the SESSS instrument prior to receiving the SSS classroom program at their school. Surveys were obtained from 418 students, with approximately equal numbers of students from each grade level. A total of 402 (96.8%) of these surveys had all the items completed and were used in subsequent analyses.

Procedures

Prior to implementation of the SSS classroom program, one researcher reviewed the SESSS instrument with the participating school counselors to determine readability and to address any questions about survey items. The school counselors administered the SESSS instrument to each class in which data were collected. Following the administration of the SESSS instrument, the school counselors sealed the completed instruments in an envelope and mailed the envelope to the researchers for analysis.

Exploratory Factor Analysis

An initial exploratory factor analysis of the 27 items on the SESSS survey was conducted using the principal axis factor method and promax oblique rotation. This data analytic method was selected because it is not reliant on multivariate normal data and it allows factors to correlate (Costello & Osborne, 2005). Allowing the factors to correlate is important because the domains measured by the SESSS are likely to be related (Costello & Osborne, 2005). The six items used for the control response set (Items 5, 8, 18, 21, 25, and 28) were not included in these analyses.

Results

Item-to-item correlations were first examined to determine if any items were so highly correlated with each other that they should be deleted from subsequent analyses to reduce redundancy. No such items were found. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was .928. Bartlett's test was significant $p < .0001$. The KMO and Bartlett's test statistics indicated that the data were suitable for factor analytic procedures (Tinsley & Tinsley, 1987).

Item-Level Analysis

Item analysis revealed departures from normality. The factor analysis method used in the current study, principal axis factoring, is not reliant on normally distributed data (Costello & Osborne, 2005). The range of responses for all items was 1 to 4. Mean scores ranged from 1.69 to 3.14. Nine items were negatively skewed (ranging between −.494 and −.056) and 17 were positively skewed (ranging between .034 and 1.215). Kurtosis statistics ranged from −1.479 to .374 with a standard error of .239. Complete descriptive statistics for the items are presented in Table 1.

Decision to Retain Factors

The decision to retain factors was initially guided by visually inspecting the scree plot, considering Eigenvalues, and balancing parsimony and plausibility. Visual inspection of the scree plot revealed that three factors appeared to be left scree, or real (e.g., left of the point where the scree plot approached asymptote); however, five factors had Eigenvalues greater than one. The break in the scree test may have been difficult to interpret because multiple data points clustered near the bend (Costello & Osborne, 2005). Although researchers have indicated that Eigenvalues may not be the most accurate indicator of factors (Costello & Osborne,

Table 1. Summary of Item Level Descriptive Statistics.

Item	Range	Mean	*SD*	Skewness	*SE*	Kurtosis	*SE*
Q1	1 to 4	2.58	1.055	.034	.120	−1.238	.239
Q2	1 to 4	2.36	1.082	.214	.120	−1.226	.239
Q3	1 to 4	2.47	1.130	.043	.120	−1.384	.239
Q4	1 to 4	2.29	1.208	.295	.120	−1.479	.238
Q6	1 to 4	1.95	1.068	.717	.120	−.838	.239
Q7	1 to 4	2.62	1.142	−.099	.120	−1.416	.239
Q9	1 to 4	2.95	1.068	−.494	.120	−1.119	.239
Q10	1 to 4	2.68	1.089	−.193	.120	−1.270	.239
Q11	1 to 4	2.58	1.142	−.056	.120	−1.418	.239
Q12	1 to 4	1.99	1.117	.713	.120	−.934	.239
Q13	1 to 4	2.84	1.107	−.390	.120	−1.235	.239
Q14	1 to 4	1.80	1.061	1.019	.120	−.368	.239
Q15	1 to 4	3.14	.975	−.731	.120	−.699	.238
Q16	1 to 4	2.01	1.061	.645	.120	−.876	.239
Q17	1 to 4	1.88	.928	.724	.120	−.505	.240
Q19	1 to 4	1.69	.945	1.215	.120	.374	.240
Q20	1 to 4	2.21	1.087	.410	.120	−1.130	.240
Q22	1 to 4	2.26	1.126	.246	.120	−1.353	.240
Q23	1 to 4	2.44	1.005	.094	.120	−1.062	.240
Q24	1 to 4	1.96	1.001	.687	.120	−.676	.240
Q26	1 to 4	2.69	1.063	−.213	.120	−1.197	.240
Q27	1 to 4	2.55	1.085	.000	.120	−1.289	.240
Q29	1 to 4	2.46	1.071	.097	.120	−1.237	.239
Q30	1 to 4	2.40	1.068	.140	.120	−1.220	.239
Q31	1 to 4	2.65	1.132	−.160	.120	−1.377	.239
Q32	1 to 4	2.19	1.039	.352	.120	−1.083	.240
Q33	1 to 4	2.71	1.103	−.191	.120	−1.323	.239

2005; Velicer & Jackson, 1990), methodologists have suggested that underfactoring is more problematic than overfactoring (Wood, Tataryn, & Gorsuch, 1996), thus there was a need to arrive at a factor solution that balanced plausibility and parsimony (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Methodologists (e.g., Costello & Osborne, 2005; Fabrigar et al., 1999) have indicated that when the number of factors to retain is unclear, then conducting a series of analyses is appropriate. Thus, three-, four-, and five-factor models were evaluated and compared to determine which model might best explain the data in the most parsimonious and interpretable fashion. Researchers evaluated models based on amount of variance explained, the interpretability (Fabrigar et al., 1999) and cleanness of structure as defined by fewest cross-loading items, and item loadings above .35 (Costello & Osborne, 2005).

Three-Factor Model

The three-factor model accounted for 40.4% of the variability in the intercorrelation matrix. All three factors had at least three items that loaded .5 or greater, indicating that all three could be considered as stable factors (Fabrigar et al., 1999). No item cross-loaded on more than one factor (>.35). Only three items (Items 4, 16, and 22) failed to load (>.35) on any factor. Item loadings are presented in Table 2.

The first factor included eight items (Items 2, 7, 9, 11, 23, 29, 30, and 31) with loadings that ranged between .413 and .804. All the items reflected intentional metacognitive

Table 2. Three-, Four-, and Five-Factor Models of SESSS: Factor Loadings Based on Principal Components Analysis and Promax Rotation With Kaiser Normalization.

	Three-Factor Model			Four-Factor Model				Five-Factor Model				
Item	C1	C2	C3	C1	C2	C3	C4	C1	C2	C3	C4	C5
1	*	*	.713	*	*	.664	*	*	.668	*	*	*
2	.524	*	*	.641	*	*	*	.639	*	*	*	*
3	*	.542	*	*	.501	*	*	*	*	.423	*	*
4	*	*	*	*	*	*	.705	*	*	*	.688	*
6	*	.676	*	*	.650	*	*	*	*	.626	*	*
7	.659	*	*	.392	*	*	.519	*	*	*	.573	*
9	.738	*	*	.622	*	*	*	.539	*	*	*	*
10	*	.625	*	*	.587	*	*	*	*	.401	*	.369
11	.804	*	*	.673	*	*	*	.612	*	*	*	*
12	*	.635	*	*	.606	*	*	*	*	*	*	.781
13	*	.489	*	*	.464	*	*	*	*	.457	*	*
14	*	.648	*	*	.610	*	*	*	*	.601	*	*
15	*	*	.547	*	*	.526	*	*	.496	*	*	*
16	*	*	*	*	*	*	.570	*	*	*	.624	*
17	*	*	*	*	.430	*	*	*	*	.403	*	*
19	*	.551	*	*	.529	*	*	*	*	*	*	.632
20	*	.499	*	*	.469	*	*	*	*	.522	*	*
22	*	*	*	*	*	*	*	*	*	*	*	.522
23	.413	*	*	.556	*	*	*	.608	*	*	*	*
24	*	*	.687	*	*	.667	*	*	.678	*	*	*
26	*	*	.526	*	*	.509	*	*	.462	*	*	*
27	*	*	.679	*	*	.667	*		.649	*	*	*
29	.559	*	*	.620	*	*	*	.666	*	*	*	*
30	.605	*	*	.693	*	*	*	.698	*	*	*	*
31	.647	*	*	.544	*	*	*	.515	*	*	*	*
32	*	.493	*	.424	.448	*	*	.453	*	.476	*	*
33	*	*	.804	*	*	.791	*	*	*	*	*	*

strategies that individuals use to keep themselves actively engaged in learning (e.g., "After I failed to reach a goal, I told myself to try a new strategy and not to doubt my ability." "I focused on positive thoughts so I would feel less stressed."). This first factor was named "Self-Management of Learning."

The second factor included 10 items (Items 3, 6, 10, 12, 13, 14, 17, 19, 20, and 32) with loadings that ranged between .443 and .676. All these items reflected the use of learning strategies related to the enactment of routines or the use of heuristic devices to improve learning (e.g., "I reviewed the most important facts that I had learned before a test." "I made an outline to help me remember important ideas."). This second factor was named "Application of Learning Strategies."

The third factor included six items (Items 1, 15, 24, 26, 27, and 33) with loadings that ranged between .526 and .804). All these items reflected the use of strategies to help other classmates learn more effectively (e.g., "I tried to help a classmate learn how to do something that was difficult for them to do." "I made sure to say something to encourage a classmate."). This third factor was named "Support of Classmates' Learning."

The three-factor solution proved to have relatively clean loadings and to be interpretable. However, in this model three items failed to load on any factor.

Four-Factor Model

The four-factor model accounted for 45% of the variability in the intercorrelation matrix. All four factors had at least three items that loaded .5 or greater, indicating that all four could be considered as stable factors (Fabrigar et al., 1999). Two items cross-loaded (>.35) on more than one factor. Item 7 loaded on both Factors 1 and 4. Item 32 cross-loaded on items Factors 1 and 2. These two items were assigned to the factor with which the correlation was highest. Only one item (Item 22) failed to load (>.35) on any factor. Item loadings are presented in Table 2.

Item loadings for the first three factors of the four-factor model were very similar to those of the three-factor model. These factor names were retained. The fourth factor included three items (Items 4, 7, and 16). Two of these items (Items 4 and 16) did not load on any factor in the three-factor model. One item (Item 7) loaded on Factor 1 in the three-factor model and on both Factors 1 and 4 in the four-factor model. All three of these items reflected the use of intentional strategies to dampen disruptive arousal, anxiety, and stress (e.g., "I imagined being in a quiet place in order to feel less stressed." "I focused on positive thoughts so I would feel less stressed." "I focused on slowing my breathing so I would feel less stressed."). Consequently this fourth factor was named "Self-Regulation of Arousal."

The factor structure of the four-factor model was not as clean as the three-factor model. The factor structure of the four-factor model possessed some cross loading items. However, two items that did not load on any factor in the three-factor model were reflected in the factor structure of the four-factor model. These items (along with one item that originally loaded on Factor 1) were conceptually consistent and distinguishable from the first three factors. Furthermore, the identification of a describable factor related to students' ability to regulate emotional arousal is theoretically consistent with the metacognitive learning literature and potentially useful in research and evaluation contexts.

Five-Factor Model

The five-factor model accounted for 49% of the variability in the intercorrelation matrix. All five factors had at least three items that loaded .5 or greater, indicating that all five could be considered as stable factors (Fabrigar et al., 1999). One item cross-loaded (>.35) on more than one factor. Item 32 loaded on both Factors 1 and 3. All items loaded (>.35) on at least one factor. Item loadings are presented in Table 2.

Item loadings for the first four factors of the four-factor model were very similar to those of the four-factor model. These factor names were retained. The first factor included three items (Items 12, 19, and 22). One of these items (Item 22) did not load on any factor in the three- or four-factor models. The remaining two items loaded on Factor 2 in the four-factor model. Although all three items reflected the intentional use of supports or strategies to support learning (e.g., "I made an outline to help me remember important ideas." "I made a picture or diagram to help me remember important ideas." "I stopped when I was reading to ask myself if I understood the most important ideas"), it was not possible to conceptually or theoretically differentiate the underlying unifying concept from Factor 2 (Application of Learning Strategies).

The factor structure of the five-factor model was relatively clean. All items loaded on at least one factor and only one item cross-loaded on more than one factor. In terms of interpretability, however, it was not possible to discriminate Factor 5 from Factor 3 on conceptual or theoretical grounds. It was therefore determined that the four-factor model represented the best model considering both its relatively clean factor structure and the interpretability of its factors. The four factors reflect: Self-Management of Learning, Application of Learning Strategies, Support of Classmates' Learning, and Self-Regulation of Arousal.

Discussion

The results of this study suggest that the SESSS has the potential to be a useful self-report

measure of elementary students' use of strategies and skills associated with enhanced academic learning and achievement. The need for valid and reliable instruments that measure student use of skills, strategies, and personal attributes associated with academic and social/relationship success has been cited as a limitation in school counseling research (Brown & Trusty, 2005). The SESSS has the potential to be used as either a screening instrument (for identifying students in need of school counseling interventions to enhance the use of learning strategies) and as an evaluation instrument (to measure the impact of school counseling interventions in the academic development domain).

The factor structure of the SESSS is consistent with several decades of educational research that has identified skills and strategies associated with academic development and achievement including cognitive and metacognitive skills (e.g., goal setting, progress monitoring, and memory skills), social skills (e.g., communication skills, social problem solving, listening, and teamwork skills), and self-management skills (e.g., managing attention, motivation, and anger; Durlak et al., 2010; Greenberg et al., 2003; Hattie et al., 1996; Marzano et al., 2001; Masten & Coatsworth, 1998; Zins et al., 2004; Wang et al., 1994). Regarding the SESSS factors, *Application of Learning Strategies* relates closely to the category cognitive and meta-cognitive skills. *Support of Classmates Learning* relates closely to social skills. Both *Self-Management of Learning* and *Self-Regulation of Arousal* relate closely to self-management with the former associated with the self-management of cognitive processes and the latter associated with the self-management of arousal and emotion. Although the actual associations of SESSS factors with specific, previously established constructs requires empirical study, it is encouraging that the factor structure determined in this research corresponds with previous research.

With additional research, SESSS has the potential to develop into a useful tool that can be used by professional school counselors and researchers to measure elementary, middle, and high school students' levels of engagement in strategies linked to the self-regulation and application of learning skills, support of classmates' learning, and self-regulation of arousal. The SESSS has several distinct benefits. It is short (33 items), can be administered in a classroom setting, and takes less than 15 minutes to complete.

Data collected on the SESSS instrument can help school counselors monitor student progress, identify barriers to learning, and increase understanding of factors affecting student behavior. A review of the SESSS student data may reveal gaps between student groups and identify the need for additional education opportunities and counseling interventions. Analysis of the SESSS student data could lead to decisions about future goals of the school counseling program and discussions with administration and staff about program improvement. Finally, results on the SESSS and changes in student attitudes and knowledge about their learning, self-regulation, and support of classmates can be shared with various stakeholders through a variety of report formats (i.e., websites, handouts, and newsletters), publications, or presentations at the local, regional, or national level. In addition, school counselors may use the SESSS instrument as a pre- and posttest measure in conjunction with delivering classroom guidance interventions. Student data on the SESSS can be used to demonstrate how school counselors can impact student academic and personal/social development related to classroom learning and achievement.

Three limitations of this study should be noted. First, because of restrictions on data collection the precise demographic characteristics of the sample are not known. The sample was drawn from a university laboratory school that is required to approximate state racial/ethnic diversity; however, lack of information on factors such as participants' socioeconomic status, special education status, and English proficiency limit the generalizability of these results. Second, a confirmatory factory analysis based on an independent sample of participants should be conducted to determine the robustness of the factor structure.

The sample size of the present study precluded splitting the sample so both an exploratory and a confirmatory analysis could be conducted. An additional study is warranted. Third, although attempts were made to make the SESSS to be as readable as possible, it is still possible that some students' scores may have been affected by the reading level of the items. Additional research investigating this possible confound and controlling for readability (e.g., by having the SESSS read to all students) is needed.

To maximize the utility of the SESSS and to address the limitations noted above, additional studies of the psychometric properties of the instrument are needed. These studies include a confirmatory factor analysis with a large, diverse sample of students; a study of the reliability and intercorrelation of the subscales; predictive validity studies (to determine the relationships between subscale scores and academic performance and achievement); and convergent and divergent validity studies (to determine the relationships between each subscale and other measures of related constructs associated with academic learning). Subsequent studies should control for readability and its possible effects on scores. The results of the present study suggest that the SESSS has the potential to be a very useful instrument and that further psychometric investigations are clearly warranted.

Declaration of Conflicting Interests

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