***Supplementary Material***

**Exploring Educational Experiences that Correlate with Self-Directed Learning in College Students Seeking to Pursue Science, Technology, Engineering, Math, and Medical (STEMM) Fields**

**Kyeorda L. Kemp1, Cameron J. Davidson1\*, Deidre N. Hurse1 , and Akshata R. Naik1\***

Oakland University William Beaumont School of Medicine Rochester,586 Pioneer Dr, Rochester, MI 48309, U.S.A

**\* Correspondence:**Corresponding Author  
naik@oakland.edu

# Supplementary Data: Survey Questions

| How would you define your race (chose all that apply)? | African American/Black (1) |
| --- | --- |
|  | Asian (2) |
|  | Native American/American Indian (3) |
|  | Pacific Islander/Native Hawaiian (4) |
|  | White/European American (5) |
|  | Other (6) Asian/PI (19) Asian/Native (12) AA/White (13) Asian/White (14) AA/Native/White (18) Native/White (15) AA/Asian (16) Native AA (17) |
|  | Prefer not to answer (7) |
| How would you define your ethnicity? |  |
|  | Hispanic/Latino, not Middle Eastern/North African/ Arab (1) |
|  | Hispanic/Latino, Middle Eastern/North African/ Arab (2) |
|  | Not Hispanic/Latino, Middle Eastern/North African/ Arab (3) |
|  | Not Hispanic/Latino, not Middle Eastern/North African/ Arab (4) |
|  | Other (5) |
|  | Prefer not to answer (6) |
|  | Selected More than 1 (7) |
| How would you define your gender? | Male (1) |
|  | Female (2) |
|  | Non-binary (3) |
|  | Other (4) |
|  | Prefer not to answer (5) |
| Please estimate your household income. |  |
|  | Less than $25,000 (1) |
|  | $25,000-49,999 (2) |
|  | $50,000-74,999 (3) |
|  | $75,000-99,900 (4) |
|  | $100,000 or more (5) |
|  | Prefer not to answer (6) |
|  |  |
| Number of individuals in your household. | 1-100... |
|  |  |
| Were you enrolled in 'Advanced Placement' (AP) or 'International Baccalaureate' (IB) classes in high school? | Yes (1) |
|  | No (2) |
|  |  |
| Did you pass your IB exam or receive AP credit? | Yes (1) |
|  | No (2) |
|  |  |
| Were you dual-enrolled in high school or took college courses while in high school? | Yes (1) |
|  | No (2) |
|  |  |
| Are you a 1st generation college student? | Yes (If neither of your parents completed an undergraduate degree) (1) |
|  | No (If either of your parents completed an undergraduate degree) (2) |
|  |  |
| What is your home zip code? |  |
| Please select yes or no for the questions below |  |
| \_1 Have you ever participated in a program or outreach activity geared at recruiting young adults, adolescents, or children into the science, engineering, technology, math, or medical fields? | Yes (1) No (2) |
| \_2 Have you ever participated in science fairs outside of those that may have been required for school? | Yes (1) No (2) |
| \_3 Have you ever participated in Math Olympics, Science Olympics, robotic clubs or competitions, or any other science, tech, engineering, math, or health-related educational competition? | Yes (1) No (2) |
| \_4 Have you ever participated in an after-school, before-school, weekend, or holiday/summer break science, tech, engineering, math, or health-related program class or camp? | Yes (1) No (2) |
|  |  |
| Are there any skills you acquired or abilities you developed through participating in programs (as described in the previous question) that have helped you be successful in your science and math courses? | Yes (1) |
|  | No (2) |
|  |  |
| Have you done any of the following? | Identifying and synthesizing information relevant to your learning needs or desires (1) |
|  | Determining the credibility of sources in order to further your learning (2) |
|  | Reporting information to others that you have identified based on your learning needs or desires (3) |
|  | Receiving feedback on your information-seeking skills and ability to assess information (4) |
|  | Incorporating and improving information-seeking skills based on the feedback received regarding your skills (5) |
|  |  |
|  |  |
| Please indicate agreement with the following strongly agree to strongly disagree |  |
| \_1 I regularly learn things on my own outside of class. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_2 I am very good at finding out answers on my own for things that the teacher does not explain in class. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_ 3 If there is something I don't understand in a class, I always find a way to learn it on my own. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_ 4 I am good at finding the right resources to help me do well in school. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_ 5 I view self-directed learning based on my own initiative as very important for success in school and in my future career. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_ 6 I set my own goals for what I will learn. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_ 7 I like to be in charge of what I learn and when I learn it. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_ 8 If there is something I need to learn, I find a way to do so right away. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_9 I am better at learning things on my own than most students. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| \_ 10 I am very motivated to learn on my own without having to rely on other people. | Strongly Disagree (1) Somewhat disagree (2) Neither agree nor disagree (3) Somewhat agree (4) Strongly agree (5) |
| **CASE A** Luke is a psychology major who had a turn of events in his personal life that made him want to pursue a career in medicine. Luke is very determined to get into medical school but does not have the subject science background or know the necessary steps required to get into a medical school. He signs up for pre-med courses and decides to take additional actions. Please rate the usefulness of the actions below in helping Luke get into medical school. |  |
| \_ 1 Watching videos and reading text regarding must know information for entering medical school | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_2 Reaching out to and interviewing current medical students about how to successfully navigate medical school acceptance | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_ 3 Setting up an appointment with a premed guidance counselor | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_ 4 Asking his friends what they would do | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_ 5 Looking at twitter/tik tok post related to getting into medical school | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
|  |  |
| **CASE B** Kiran has an exam in their chemistry class in two weeks. They are feeling nervous about the material and about how to prepare for the exam. Kiran has been reading the textbook and reviewing their notes. They recently took a practice quiz and did poorly. They are unsure how to proceed with the material. Kiran finds this frustrating because they aim to be a pharmacist. How would you rate the following behaviors on a scale regarding their usefulness to Kiran’s future? |  |
| \_1 Seek out videos and other materials on the subject and use this to prepare for additional practice questions provided by the professor | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_2 Memorize the correct answers to the practice quiz questions | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_3 Ask to borrow a friend’s notes in order to copy them | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_4 Review questions they get correct or incorrect to determine why they got them correct or incorrect | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_5 Seek feedback or help from the chemistry teaching assistant and/or the professor on the questions that they got incorrect | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_6 Just accept the fact that chemistry is not their thing and move on to picking a new career | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_7 Feel good that their biology grades are so much higher than chemistry and stop worrying about chemistry grades | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_8 Set learning goals for the next two weeks and seek out materials and resources that can help them meet these goals and objectives | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |
| \_9 Seek feedback from their teaching assistant or professor on the quality of sources they are using to learn the material | Not at all useful (1) Slightly useful (2) Moderately useful (3) Very useful (4) Extremely useful (5) |

# Note, the areas grayed out were removed from analysis as they did not map onto the 7 components of SDL and did not correlate with the previously validated surveys focused on SDL.

# Supplementary Figures and Tables

Details on results of tests to validate the cases. Note, Case A was dropped from the study. As it only mapped to 4 of the seven components of SDL and did not correlate as strongly with the existing SDL measures as Case B. See below. Areas grayed out were removed from analysis.

Supplemental Table 1: Correlation and mapping of the situational questions for case A.

|  |  | **1. Take the initiative for one’s own learning** | **2. Self-assess/diagnose one’s own learning needs** | **3. Formulate learning goal** | **4. Identifying resources** | **5. Appraise information resources** | **6. Implement appropriate activities** | **7. Evaluate learning outcomes** | **Correlation with question 1 of Case A** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** |  | x | x |  | x |  | pos |  | 1 |
| **2** | x | x |  | x |  | pos |  | 0.430, *p*<0.001 |
| **3** | x | x |  | x |  | pos |  | 0.313, *p*<0.001 |
| **4** | x | x |  | x |  | neg |  | 0.131, *p*= 0.026 |
| **5** | x | x |  | x |  | neg |  | 0.149, *p*= 0.012 |

Situational questions were mapped to the SDL framework. Pearson correlations were run between the  question one of the case and the other questions.

Supplemental Table 2: Correlation and mapping of the situational question for case B.

|  |  | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **1. Take the initiative for one’s own learning** | **2. Self-assess/diagnose one’s own learning needs** | **3. Formulate learning goal** | **4. Identifying resources** | **5. Appraise information resources** | **6. Implement appropriate activities** | **7. Evaluate learning outcomes** | **Correlation to question 1 of Case B** |
|  | **#1** | x | x | x | x |  | pos | x | 1 |
|  | **#2** | x | x |  |  |  | neg |  | 0.182, *p*= 0.002 |
|  | **#3** | x |  |  | x |  | neg |  | 0.101, *p*= 0.089 |
|  | **#4** | x | x | x |  |  | pos | x | 0.310,  *p*<0.001 |
|  | **#5** | x | x |  | x | x | pos | x | 0.346,  *p*<0.001 |
|  | **#6** |  |  |  |  |  | neg |  | -0.002, *p*=0.974 |
|  | **#7** |  |  |  |  |  | neg |  | 0.034, p=0.562 |
|  | #8 | x | x | x | x | x | pos |  | 0.358, *p*<0.001 |
|  | #9 | x | x |  | x | x | pos | x | 0.421, *p*<0.001 |

Situational questions were mapped to the SDL framework. Pearson correlations were run between the question one of the case and the other questions.  Those that did not map and/or correlate with other questions were removed (gray filled rows) from the case prior to assessing how the cases mapped to the existing measures (see below).

Supplemental table 3 : Correlation between SDL situational judgment cases and existing SDL measures

|  | **SDL experiences** | **SDL disposition** |
| --- | --- | --- |
| Case A **(dropped from the study)** | 0.076, *p*=0.221 | 0.339, *p*<0.001 |
| Case B **(selected for the study)** | 0.368, *p*<0.001 | 0.557, *p*<0.001 |

****