“Want To” vs “Need To” Leave: The Impact of EF Deficits

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BACKGROUND

Persistence = % of students who re-enroll the following Fall after matriculation

- Undergraduate (UG) engineering program persistence rates are consistently below the average UG program persistence rate at the University of Denver (DU) (**Table 1**).
- This trend suggests degree-seeking students may face barriers that ultimately lead to their leaving of the engineering program in pursuit of another field of study.

Table 1 – Persistence of 2nd year first-time-first-year (FTFY) UG engineer degree-seeking students compared to the average across all UG programs at DU for academic year cohorts 2016-2021.

Cohort Year	2016	2017	2018	2019	2020	2021
Cohort Size	n = 90	n = 97	n = 96	n = 78	n = 86	n = 73
Persistence in Engineering (%)	**71.1**	**76.3**	**74.0**	**66.7**	**72.1**	**78.1**
Persistence at DU (%)	*91.1*	*86.6*	*82.3*	*75.6*	*79.1*	*84.9*
Average persistence across all DU UG programs (%)	80.9	81.0	77.5	78.3	78.5	80.5

Executive Functioning (EF) = “*self-regulation across time for the attainment of one’s goals (self-interests), often in the context of others*”[1]

Five Dimensions of EF[2]**:**

1. Self-Management to Time
2. Self-Organization/Problem Solving
3. Self-Restraint
4. Self-Motivation
5. Self-Regulation of Emotion

EF Deficits are associated with…

- ↓ academic achievement[3]
- ↓ test performance[5]
- ↓ educational attainment[1]
- ↑ procrastination[4]
- ↑ likelihood of ADHD[3]

Meeting the demands of an engineering degree is especially challenging for students experiencing impairments due to EF deficits.[6,7]

RESEARCH QUESTIONS

→ What is **the prevalence of students with EF deficits** in our undergraduate engineering classrooms?

→ What is the **prevalence of students with high likelihood of ADHD** in our undergraduate engineering classrooms?

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METHODS

The **Barkley Deficits in Executive Functioning Scale Self-Report (BDEFS)** is an empirically and theoretically based tool for assessing the dimensions of EF in daily life for adults ages 18-81.

- The BDEFS Self-Report is is available in a Long Form (BDEFS-LF; 89 items) and Short Form (BDEFS-SF; 20 items).
- Individuals self-rate items on a 4-point Likert scale in reference to the past six months (1 = never or rarely; 4 = very often).
- A “symptom of deficient EF” is any item answered with a 3 or 4.
- The BDEFS has demonstrated satisfactory 2- to 3-week test-retest reliability and satisfactory validity for measuring EF in a national adult sample.[1]

Assessment Materials

- **BDEFS-SF** (20 items; Cronbach’s α = 0.918) → used to assess **likelihood of EF deficiencies**
- **ADHD-EF** (subset of 11 items from the BDEFS-LF; Cronbach’s α = 0.842) → used to assess **likelihood of Adult ADHD**
- **Scoring sheets** for BDEFS-SF and ADHD-EF items relative to the general population (normative sample)

Participants

- 2nd, 3rd, & 4th year UG engineer degree seeking students at DU participated in this study (n=41).

Data Collection

- An anonymous online Qualtrics survey was used for collect student self-ratings of BDEFS-SF and ADHD-EF items.

Data Analysis

- Total EF Summary Scores, EF Symptom Counts, and ADHD-EF Index Scores were calculated and compared to percentile ranges based on the general population (normative sample) (**Tables 2** & **3**).

Table 2. Scoring measures to assess likelihood of EF deficits and adult ADHD. The Total EF Summary Score is considered the most valid score of the BDEFS-SF.[1]

Scoring Measure	Score Calculation	Interpretation
Total EF Summary Score	sum of all individual BDEFS-SF item scores	↑ score indicates ↑ EF deficits a score ≥ 75th percentile of the normative sample is considered to be clinically significant
EF Symptom Count	number of BDEFS-SF items answered as 3 (often) or 4 (very often)	↑ count indicates EF deficits in ↑ areas a score ≥ 75th percentile of the normative sample is considered to be clinically significant
ADHD-EF Index Score	sum of all the individual ADHD-EF item scores	↑ index indicates ↑ likelihood of ADHD an index ≥ 20 is considered to be a clinically significant predictor of adult ADHD

Table 3. Higher percentiles correspond to an increased likelihood for some level of impairment due to EF deficits.[1]

Percentile Range	Interpretation
76-84%	marginal clinical significance
84-92%	borderline or somewhat deficient
93-95%	mildly deficient
96-98%	moderately deficient
≥99%	severe or markedly deficient

RESULTS

Table 4 – Descriptive Statistics. The means of all measures were above the threshold for clinical significance. Data shown below are represented by mean ± standard deviation.

EF Summary Score	EF Symptom Count	ADHD-EF Index Score
36.76 ± 8.56	4.15 ± 3.71	20.95 ± 4.74

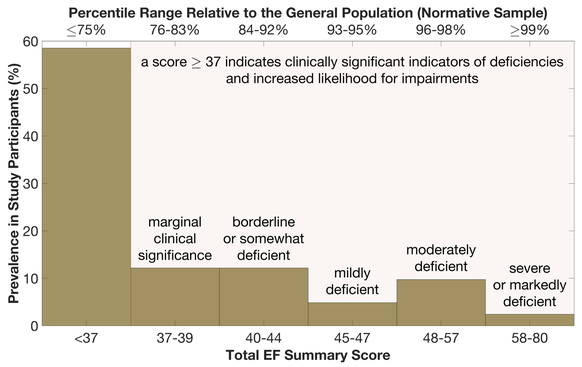

Figure 1 – Total EF Summary Score. Approximately 2 out of every 5 participants (41.5%) had a score of clinical significance (≥37). 17.1% of participants self-reported mild to severe deficiencies (≥93th percentile range) while 24.4% self-reported deficiencies of marginal to borderline significance (76th-92nd percentile range).

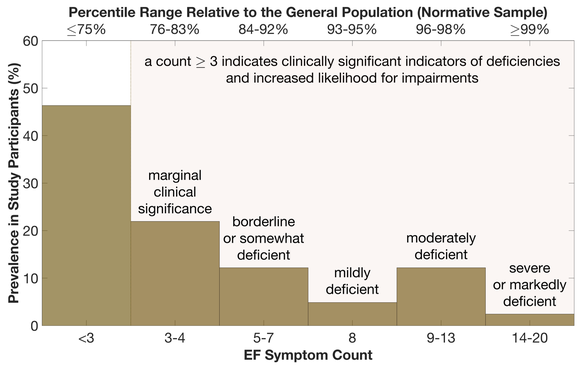

Figure 2 – EF Symptom Count. Over half of participants (53.7%) self-reported a symptom count of clinical significance (≥3). Approximately 1 out of every 5 participants (19.5%) self-reported a symptom count ≥ 8, indicating mild to severe likelihood for impairments due to EF deficiencies.

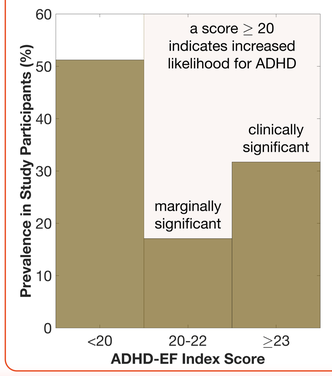

Figure 3 – ADHD-EF Index Score. Approximately 1 out of every 2 participants (48.8%) had score indicative of a high likelihood for adult ADHD.

CONCLUSIONS

KEY TAKEAWAYS

1. **Likelihood of EF Deficiencies →** On average, engineering students had **clinically significant indicators of EF deficiencies** and **increased likelihood for impairments** as the result of those deficiencies.
2. **Likelihood of Adult ADHD →** Approximately 1 out of every 2 students had a **high likelihood for adult ADHD**.

Study Limitations

- Due to small sample size and lack of demographic data, the results of this research may not provide a complete picture of the different needs of engineering students in our classrooms.
- The BDESF-SF contains only 20 items; therefore separate scores for each of the five major EF dimensions are not provided/ recommended.[1]

FUTURE WORK

- Increase sample size and collect data from 1st year students (more data!).
- Collect longitudinal data to observe changes and trends in self-reported EF symptoms over the span of a student’s participation in the UG engineering program.
- Implement the 89 item BDEFS-LF to obtain separate scores for each of the EF dimensions.
- Implement teaching practices to support students with EF deficiencies based on research results.

INTERACTIVE SECTION

Curious about your own EF skills?

Scan the QR code to self-rate the BDEFS-SF and ADHD-EF items and, based on your age, use the tables below to interpret your score!

	Ages 18-34			Ages 35-49		
Percentile Range (%)	Total EF Summary Score	EF Symptom Count	ADHD-EF Index	Total EF Summary Score	EF Symptom Count	ADHD-EF Index
≥ 99	58-80	14-20	33-44	58-80	14-20	32-44
96-98	48-57	9-13	29-32	51-57	9-13	28-31
93-95	45-47	8	26-28	45-50	7-8	25-27
84-92	40-44	5-7	23-25	37-44	4-6	21-24
76-83	37-39	3-4	21-22	33-36	2-3	19-20
≤ 75	20-36	0-2	11-20	20-32	0-1	11-18

	Ages 50-64			Ages 65-81		
Percentile Range (%)	Total EF Summary Score	EF Symptom Count	ADHD-EF Index	Total EF Summary Score	EF Symptom Count	ADHD-EF Index
≥ 99	56-80	13-20	30-44	45-80	9-20	25-44
96-98	48-55	9-12	26-29	40-44	5-8	23-24
93-95	42-47	7-8	24-25	38-39	4	21-22
84-92	38-41	4-6	21-23	35-37	2-3	19-20
76-83	35-37	2-3	20	33-34	1	18
≤ 75	20-34	0-1	11-19	20-32	0	11-17