

## **Can we find a correlation between students' resilience and academic performance?**

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### **Abstract**

The American Psychological Association defines resilience as the process and outcome of successfully adapting to difficult or challenging life experiences, especially through mental, emotional, and behavioral flexibility and adjustment to external and internal demands. To have a successful career in civil engineering, would-be engineers must possess the necessary intrapersonal skill of resilience. Resilience also assists would-be engineers to realize successful academic rigor and retention in tertiary institutions. The skill of resilience is not solely innate to a particular individual but can be both developed and inculcated. This research assesses the correlation between resilience and academic performance, using protective factors such as optimism, adaptability, self-sufficiency, and persistence. Subsequently, this research will identify key factors that educators can instill in students to enhance resiliency in the classroom.

### **Introduction**

Life challenges are inevitable. According to Job 5:7 in the Holy Writ, man is destined for trouble from the moment of his birth, as surely as sparks fly upward. One of the key abilities one must develop or possess to successfully traverse life's twists and turns and overcome its problems is resilience. Engineering students require resilience to handle the demands and difficulties of studying engineering and to deal more effectively with future challenges.

The origin of resilience has been discussed from a variety of angles. Some think it's an innate talent that considers a range of genetic, developmental, psychological, and environmental elements and is based on a variety of neurobiological systems. ([2], [3], [4], [5]). Others, including the author, believe that resilience is merely developmental and that anyone can build it to triumph over life's ups and downs. According to Prince-Embury (2014), there are three basic systems that are essential for the growth of resilience: a sense of mastery, a sense of relatedness, and emotional reactivity. Optimism, adaptability, and self-perceived competence or self-efficacy are all components of a sense of mastery. A sense of relatedness includes trust in others, access to support, social comfort,

and tolerance of differences. Emotional reactivity refers to one's self-perceived relative sensitivity and intensity of reaction, the amount of time it takes to recover from an emotionally evoking situation, and the degree to which this interferes with daily functioning.

## **Methods**

Fifty students in two engineering courses, CPS and CEM, participated voluntarily in the study under strict anonymity. The test instrument used was a fifty-item Psychometric Resilience Test questionnaire [6]. Responses on the questionnaire are given on a five-point Likert scale as the participant perceives them to be true, with one on the scale denoting “very inaccurate” and five denoting “very accurate.” Five essential resilience factors were investigated, namely optimism, adaptability, persistence, self-sufficiency, and self-control. The test instrument used has been validated by previous research that employed a PRT questionnaire [1]. Descriptive statistics and simple percentages are used to summarize the research data.

## **Analysis and Results**

### **Optimism**

The results of the optimism items for courses CPS and CEM are presented in Figures 1 and 2 and are summarized as follows:

1<sup>st</sup> item: For the CPS course, 33% of the students indicated as very accurate the statement “I look on the bright side of life,” and 37% indicated as moderately accurate the statement. Ten percent indicated that the statement was very inaccurate. For the CEM course, 25% indicate as very accurate that they look on the bright side of life, and 40% indicate that the statement is moderately accurate. Ten percent indicated that the statement is moderately inaccurate.

2<sup>nd</sup> item: For the CPS course, 40% of the students indicated as very accurate that they never give up, 27% indicated as moderately accurate the same statement, while 7% indicated the same statement as very inaccurate and 7% as moderately inaccurate that they never give up. For the CEM course, 15% indicated that they never give up, 40% indicated that it is moderately accurate on the same item, 5% indicated that it is moderately inaccurate, and 5% indicated that it is very inaccurate on the same item.

3<sup>rd</sup> item: For the CPS course, 33% of the students indicated as very accurate that they love life; 33% also indicated as moderately accurate the same item; 7% indicated as very inaccurate; and 7% indicated as very inaccurate that they love life. For the CEM course, 35% indicated as very accurate that they love life, 45% indicated as moderately accurate the same item, 5% indicated as moderately inaccurate, and another 5% as very inaccurate the statement.

4<sup>th</sup> item: For the CPS course, 43% of the students indicated as very accurate the statement “I work on improving myself”, 10% indicated as moderately accurate the same statement, and 7% and 10% indicated as moderately and very inaccurate, respectively, the same statement. For the CEM course, 55% and 35% indicate the statement as very accurate and moderately accurate, respectively.

5<sup>th</sup> item: For the CPS course, 27% of the students indicated as very accurate the statement “I feel comfortable with myself,” 37% indicated as moderately accurate the statement, while 7% and 10% indicated as moderately and very inaccurate, respectively, the same statement. For the CEM course, 30% and 40% indicated the statement as very accurate and moderately accurate, respectively, while 10% indicated it as moderately inaccurate.

### **Adaptability**

The results of the adaptability items are presented in Figures 3 and 4 and are summarized as follows:

1<sup>st</sup> item: For the CPS course, 27% of the students responded as very accurate, and 50% responded as moderately accurate, indicating that they adapt easily to new situations. Ten percent responded that the statement was moderately inaccurate as it applied to their ability to adapt to new situations. For the CEM course, 35% indicated the item as very accurate, 35% indicated it as moderately accurate, and 30% indicated that the statement is moderately inaccurate.

2<sup>nd</sup> item: For the CPS course, 27% of the students indicated as very accurate and 53% indicated as moderately accurate the statement "I am good at taking advice." Three percent indicated that the statement is moderately inaccurate as it pertains to their taking the advice of others. For the CEM course, 25% indicated the item as very accurate, and 35% indicated it as moderately accurate. Ten percent indicated the item as moderately inaccurate.

3<sup>rd</sup> item: For the CPS course, 33% of the students indicated as very accurate and 50% indicated as moderately accurate the statement “Can stand criticism.” Ten percent of the class indicated that the statement was moderately inaccurate. For the CEM course, 20% indicated it as very accurate, and 30% indicated the item as moderately accurate. 10% said the item was very inaccurate, while 20% said it was moderately inaccurate.

4<sup>th</sup> item: For the CPS course, 13% of the students indicated it as very accurate and 47% indicated it as moderately accurate, indicating that they respond well to change. Thirteen percent and 3% indicated it as moderately inaccurate and very inaccurate, respectively, with the same statement that they respond well to changes. For the CEM course, 10% indicate the statement as very accurate and 10% as moderately accurate, respectively. Five percent indicated the statement as very inaccurate, and 30% indicated it as moderately inaccurate.

5<sup>th</sup> item: For the CPS course, 30% of the students indicated it as very accurate and 30% indicated it as moderately accurate, indicating that they can handle opposition. 10% indicate it as moderately inaccurate, and 10% indicate it as very inaccurate, with the same statement that they can handle opposition. For the CEM course, 5% and 60% indicated the statement as very accurate and moderately accurate, respectively, while 10% indicated it as moderately inaccurate.

### **Persistence**

The results of the persistence items are presented in Figures 5 and 6 and are summarized as follows:

1<sup>st</sup> item: For the CPS course, 44% of the students indicated the statement "I am a hard worker" as very accurate and 40% indicated it as moderately accurate. Three percent of the respondents indicated the statement as very inaccurate and 3% as moderately inaccurate. For the CEM course, 45% rate the statement as very accurate, while 45 rate it as moderately accurate.

2<sup>nd</sup> item: For the CPS course, 7% of the students indicated it as very accurate and 10% indicated it as moderately accurate, with the statement “Feel that work is not an important part of my life.” Forty percent of the respondents indicated the statement as very inaccurate and 33% as moderately inaccurate. For the CEM course, 5% rate the statement as very accurate, while 20% rate it as moderately accurate. The statement was rated as very inaccurate by 35% of respondents and moderately inaccurate by 20%.

3<sup>rd</sup> item: For the CPS course, 20% of the students indicated it as very accurate, and 53% indicated it as moderately accurate, with the statement “Finish things despite obstacles in the way.” Seven percent indicated the statement as very inaccurate. For the CEM course, 25% indicated a statement as very accurate and 60% as moderately accurate.

4<sup>th</sup> item: For the CPS course, 7% of the students indicated it as very accurate and 2% indicated it as moderately inaccurate: “Put little time and effort into my work.” Forty-three percent indicated it as very inaccurate, and 27% indicated it as moderately inaccurate. For the CEM course, 25% indicated a moderately inaccurate statement, while 30% indicated a very inaccurate statement and 40% indicated a moderately inaccurate statement.

5<sup>th</sup> item: For the CPS course, 14% of the respondents indicated it as very accurate and 53% as moderately accurate, with the statement “Accomplish a lot of work.” Ten percent indicated the statement as moderately inaccurate. For the CEM course, 15% and 50% indicated the statement as very accurate and moderately accurate, respectively, while 10% indicated it as moderately inaccurate.

### **Self-sufficiency**

The results of the self-sufficiency items are presented in Figures 7 and 8 and are summarized as follows:

1<sup>st</sup> item: For the CPS course, 7% of the students indicated as very accurate and 13% as moderately accurate the statement “Need protection.” Twenty percent indicated it as very inaccurate, and 27 as moderately inaccurate. For the CEM course, 20% indicated the statement as moderately accurate, 30% indicated it as very inaccurate, and 40% indicated it as moderately accurate.

2<sup>nd</sup> item: For the CPS course, 10% of the students indicated it as very accurate and 13% as moderately accurate, with the statement “Often need help.” Thirty percent rated the statement as moderately inaccurate, while 7% rated it as extremely inaccurate. For the CEM course, 5% indicated it as very accurate, 20% indicated it as moderately accurate, 35% indicated it as very inaccurate, and 15% indicated it as moderately inaccurate.

3<sup>rd</sup> item: For the CPS course, 3% of the students indicated it as very accurate and 13% as moderately accurate, with the statement “I am easily moved to tears.” Thirty percent indicated it as very inaccurate, and 27% as moderately inaccurate. For the CEM course, 10% indicated the

statement as moderately accurate, 45% indicated it as very inaccurate, and 25% indicated it as moderately inaccurate.

4th item: For the CPS course, 7% of students indicated that the statement "Let others determine my choices" was moderately accurate. Thirty percent indicated the statement as very inaccurate, and 40% indicated it as moderately inaccurate. For the CEM course, 5% indicated the statement as very accurate, 30 indicated it as very inaccurate, and 55% indicated as moderately inaccurate.

5<sup>th</sup> item: For the CPS course, 3% of the students indicated as very accurate and 10% as moderately accurate the statement "Let myself be directed by others." Thirty percent indicate the statement to be very inaccurate, and 40% indicate it as moderately inaccurate. For the CEM course, 15% indicated the statement as moderately accurate, 35% indicated it as very inaccurate, and 20% indicated it as moderately inaccurate.

### **Self-control**

The results of the self-control items are presented in Figures 9 and 10 and are summarized as follows:

1<sup>st</sup> item: For the CPS course, 27% of the students indicated as very accurate the statement "Make rash decisions," 23% indicated it as moderately inaccurate, and 17% indicated it as very inaccurate. For the CEM course, 10% indicated it as moderately accurate, 10% indicated it as very inaccurate, and 35% indicated it as moderately inaccurate.

2<sup>nd</sup> item: For the CPS course, 24% of the students indicated as moderately accurate the statement "Experience very few emotional highs and lows." Thirty percent indicated that the statement is moderately inaccurate, and 17% indicated it is very inaccurate. For the CEM course, 5% indicated it as very accurate, 25% indicated it as moderately accurate, 10% indicated it as very inaccurate, and 35% indicated it as moderately inaccurate.

3<sup>rd</sup> item: For the CPS course, 10% of the students indicated the statement Give in to urges as very accurate and 30% indicated it as moderately y accurate. Twenty percent indicated the statement to be moderately inaccurate, while 7% indicated it as very inaccurate. For the CEM course, 10% indicated the statement as very accurate, 35% indicated it as moderately accurate, 5% indicated it as very inaccurate, and 25% indicated it as moderately inaccurate.

4<sup>th</sup> item: For the CPS course, 10% of the students indicated as very accurate the statement “talk about my worries,” and 20% indicated it as moderately accurate. Seventeen percent and 30% indicated the statement as very inaccurate and moderately inaccurate, respectively. For the CEM course, 25% and 40% indicated the statement as very accurate and moderately accurate, respectively. Fifteen percent indicated the statement as very inaccurate, and 10% indicated it as moderately inaccurate.

5th item: In the CPS course, 30% of students rated the statement "Never spend more than I can afford" as very accurate, while 27% rated it as moderately accurate. Seven percent and 17% indicated the statement to be very inaccurate and moderately inaccurate, respectively. For the CEM course, 10% and 15% indicated the statement as very accurate and moderately accurate, respectively, while 20% indicated it as very inaccurate and 40% indicated the statement as moderately inaccurate.

## **Discussion**

- **Optimism**

In life, setbacks and failure are common. Optimism is closely linked to resilience—the ability to bounce back from setbacks and adversity. Optimistic individuals tend to approach problems with a “can-do” attitude. They are better equipped to cope with challenges, learn from them, and continue to move forward. They are less likely to become overwhelmed by stress, as they tend to view challenges as temporary and surmountable. Their belief that challenges can be overcome makes them more likely to seek creative ways to solve problems. The responses of the students to the optimism items are generally impressive, as presented in Table 1. However, there were significant differences in the responses to items 2 and 4 between the two classes surveyed in this work. CPS fared better than CEM on item 2, while vice versa was the case on item 4.

- **Adaptability**

Adaptability is crucial in life because it enables an individual to thrive in a rapidly changing world and always remain an asset. It is a skill that empowers an individual to navigate uncertainty and achieve long-term growth and resilience. The students’ responses to the adaptability items are the same for both classes, except for item 3, as shown in Table 1. The CPS response to the item was



better than that of CEM. The ability to stand criticism is essential for resilience to forge ahead and achieve set goals.

- Persistence

Persistence is necessary for accomplishing tasks and achieving long-term goals. Many projects and objectives require consistent effort, and without persistence, it is easy to give up when faced with obstacles and setbacks. A persistent individual is better equipped to handle rejection, criticism, and failure. The responses of the two surveyed classes are the same as presented in Table 1 and seem very good.

- Self-sufficiency

Self-sufficient individuals tend to be more resilient in the face of challenges and setbacks. They don't crumble when faced with difficulties but instead find ways to overcome them. Self-sufficient individuals can work independently and do not need constant supervision or assistance. They can manage their time efficiently, are resourceful, and can think critically to find solutions when they encounter challenges. There were no statistically significant differences between both classes on the self-sufficiency items, as shown in Table 1. Generally, the responses of the two classes on the self-sufficiency items were similar and impressive.

- Self-control

Self-control is an important skill for several reasons. It helps individuals manage their emotions effectively. In an educational or professional setting, self-control plays a significant role in decision-making. In such a setting, it is necessary to maintain composure, even in stressful circumstances. This skill enables individuals to handle criticism, conflict, and pressure without reacting impulsively. In decision-making, self-control enables individuals to think rationally and make informed choices rather than succumb to impulsive or emotional reactions. The responses of students to the self-control items were similar and good, except for items 2 and 5. CPS responses to the two items were better than those of the CEM. Experiencing many emotional highs and lows

and spending more than one can afford will erode the resilience skills needed to overcome life challenges.

Table 1. Descriptive statistics of class response to resilience factor items

Resilience Factors	CEM	CPS	T-test
	Means $\pm$ SD	Means $\pm$ SD	
<b>Optimism</b>			
1. I look on the bright side of life	3.80 $\pm$ 0.95	3.80 $\pm$ 1.24	<i>n. s.</i>
2. I never give up	3.45 $\pm$ 1.10	3.97 $\pm$ 1.03	<i>p</i> < 0.05
3. I love life	4.00 $\pm$ 1.08	3.80 $\pm$ 1.19	<i>n. s.</i>
4. I work on improving myself	4.45 $\pm$ 0.69	3.83 $\pm$ 1.34	<i>p</i> < 0.05
5. I feel comfortable with myself	3.90 $\pm$ 0.97	3.63 $\pm$ 1.25	<i>n. s.</i>
<b>Adaptability</b>			
1. I adapt easily to new situations	3.75 $\pm$ 1.25	3.93 $\pm$ 0.91	<i>n. s.</i>
2. I am good at taking advice	3.75 $\pm$ 0.97	4.03 $\pm$ 0.76	<i>n. s.</i>
3. I can stand criticism	3.30 $\pm$ 1.31	4.07 $\pm$ 0.91	<i>p</i> < 0.05
4. I respond well to change	3.35 $\pm$ 1.31	3.53 $\pm$ 1.00	<i>n. s.</i>
5. I can handle opposition	3.60 $\pm$ 0.75	3.60 $\pm$ 1.30	<i>n. s.</i>
<b>Persistence</b>			
1. I am a hard worker	4.35 $\pm$ 0.67	4.17 $\pm$ 0.99	<i>n. s.</i>
2. I feel that work is not an important part of my life	2.40 $\pm$ 1.31	2.10 $\pm$ 1.24	<i>n. s.</i>
3. I finish things despite obstacles in the way	3.95 $\pm$ 1.00	3.80 $\pm$ 1.00	<i>n. s.</i>
4. I put little time and effort into my work	2.25 $\pm$ 1.16	2.03 $\pm$ 1.19	<i>n. s.</i>
5. I accomplish a lot of work	3.70 $\pm$ 0.86	3.70 $\pm$ 0.84	<i>n. s.</i>
6. I put work above pleasure	2.90 $\pm$ 1.02	2.70 $\pm$ 1.24	<i>n. s.</i>
<b>Self-sufficiency</b>			
I need protection	2.20 $\pm$ 1.11	2.60 $\pm$ 1.16	<i>n. s.</i>
I often need help	2.45 $\pm$ 1.32	2.90 $\pm$ 1.06	<i>n. s.</i>
I am easily moved to tears	1.95 $\pm$ 1.05	2.33 $\pm$ 1.15	<i>n. s.</i>
I let others determine my choices	1.90 $\pm$ 0.79	2.06 $\pm$ 0.91	<i>n. s.</i>
I let myself be directed by others	2.25 $\pm$ 1.12	2.40 $\pm$ 1.13	<i>n. s.</i>
<b>Self-control</b>			
1. I make rash decisions	2.55 $\pm$ 0.83	2.70 $\pm$ 1.06	<i>n. s.</i>
2. I experience very few emotional highs and lows	2.80 $\pm$ 1.11	2.67 $\pm$ 1.00	<i>n. s.</i>
3. I give in to my urges	3.20 $\pm$ 1.10	3.17 $\pm$ 1.09	<i>n. s.</i>
4. I talk about my worries	3.50 $\pm$ 1.40	2.77 $\pm$ 1.25	<i>p</i> < 0.05
5. I never spend more than I can afford	2.55 $\pm$ 1.28	3.52 $\pm$ 1.27	<i>p</i> < 0.005

Note: *n. s.* = not significant at alpha equal 0.05; *p* < 0.05 = significant at alpha equal 0.05; *p* < 0.005 = highly significant at alpha equal 0.005.

Table 2. Statistics of Course Academic Performance

Course	Midterm Exam	Final Exam
CEM	74.14 ± 12.65	72.36 ± 19.47
CPS	84.61 ± 10.46	76.33 ± 11.73
T-test	$p < 0.005$	Not significant

- Relationship between Resilience and Academic Performance of the Surveyed Courses

The class average scores in the midterm examination and the final examination of the two courses surveyed in the study are presented in Table 2. The results show that the performance of CPS, especially in the midterm examination, was better than that of CEM, and this correlates with the results of the resilience study.

- Towards Enhancing Students' Resilience Skill

Faculty members and staff can play a significant role in enhancing students' academic and professional resilience skills. Here are a few of the several strategies faculty and staff can employ to foster resilience among their students.

- Foster Growth Mindset: Promote the idea that intelligence and abilities can be developed through effort and perseverance rather than being fixed traits and encourage students to view setbacks as opportunities for learning and growth.
- Offer Flexibility and Accommodations: Understanding students' individual circumstances and considering offering reasonable accommodation, when necessary, will immeasurably enhance the resilience skills of the students. Faculty allowing flexibility with assignment deadlines or alternative assessment methods for students facing challenges will make the students feel that their uniqueness is to be celebrated rather than being seen as a weakness.
- Be supportive and approachable. To help the students develop resilience skills, faculty and staff should show empathy and understanding towards students facing challenges, both academic and personal, and should offer encouragement and guidance when the students are navigating such a difficult period.

## Conclusions

Resilience is one of the intrapersonal skills necessary for a successful career in engineering. This valued professional skill could be both developed and inculcated. This research assessed the resilience of future civil engineers by measuring protective factors such as optimism, adaptability, self-sufficiency, persistence, and self-control and correlated the findings with the students' academic performance. The study also suggests some ways faculty and staff could help enhance the resilience of future engineers.

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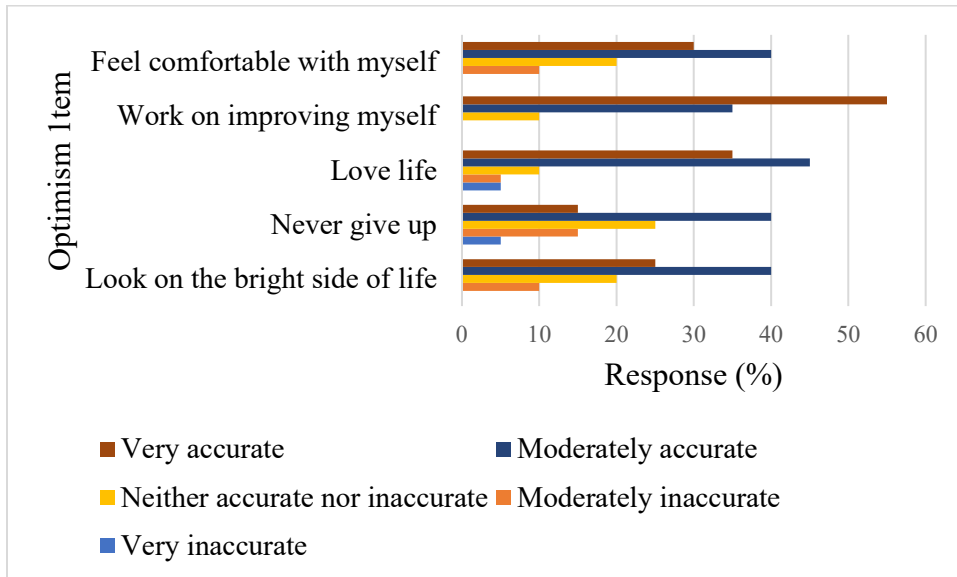


Figure 1. Response to the optimism items (CEM)

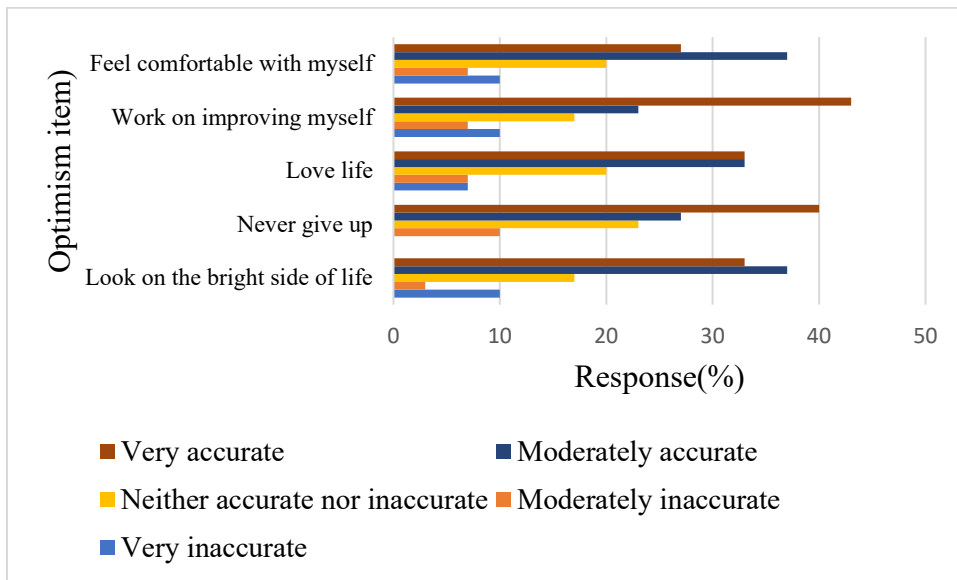


Figure 2. Response to the optimism items (CPS)

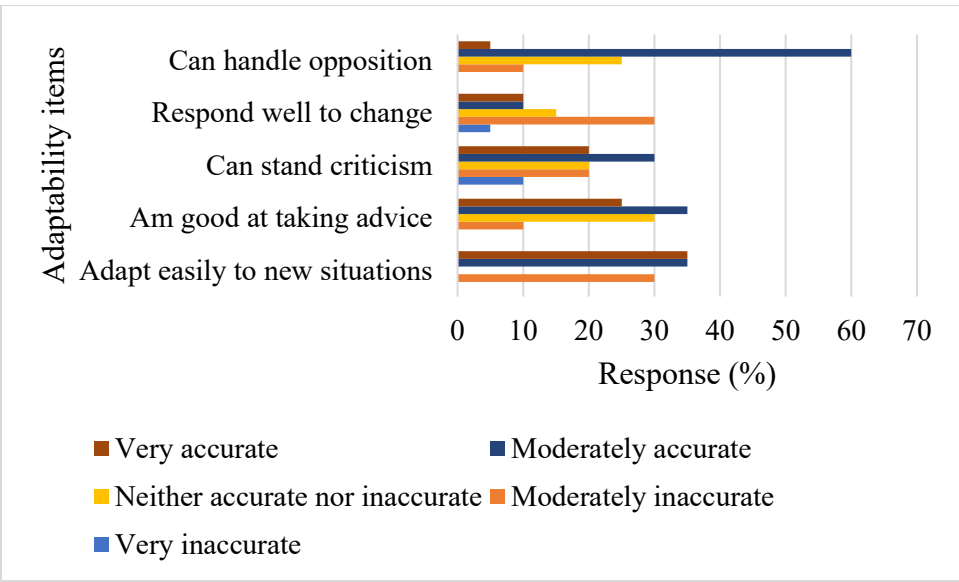


Figure 3. Response to the adaptability items (CEM)

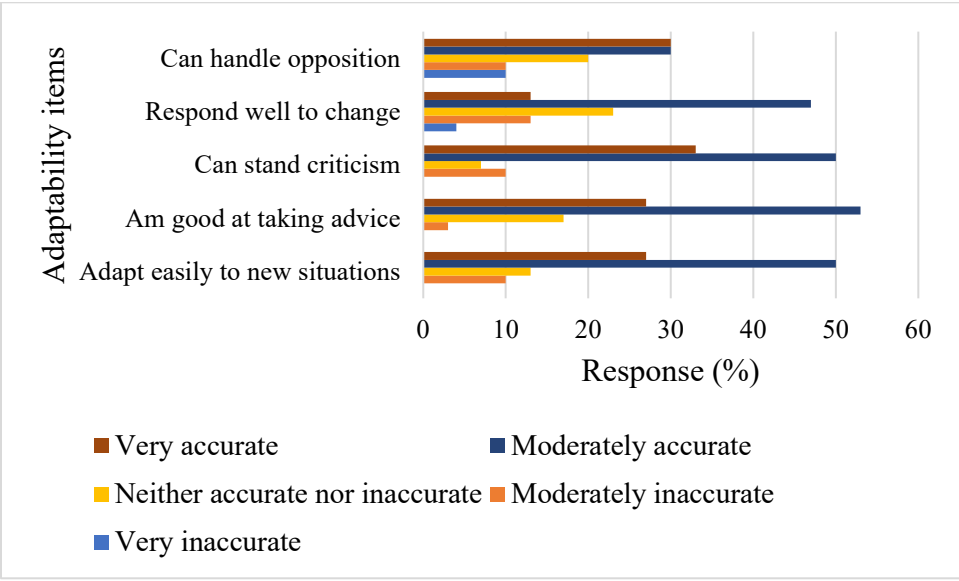


Figure 4. Response to the adaptability items (CPS)

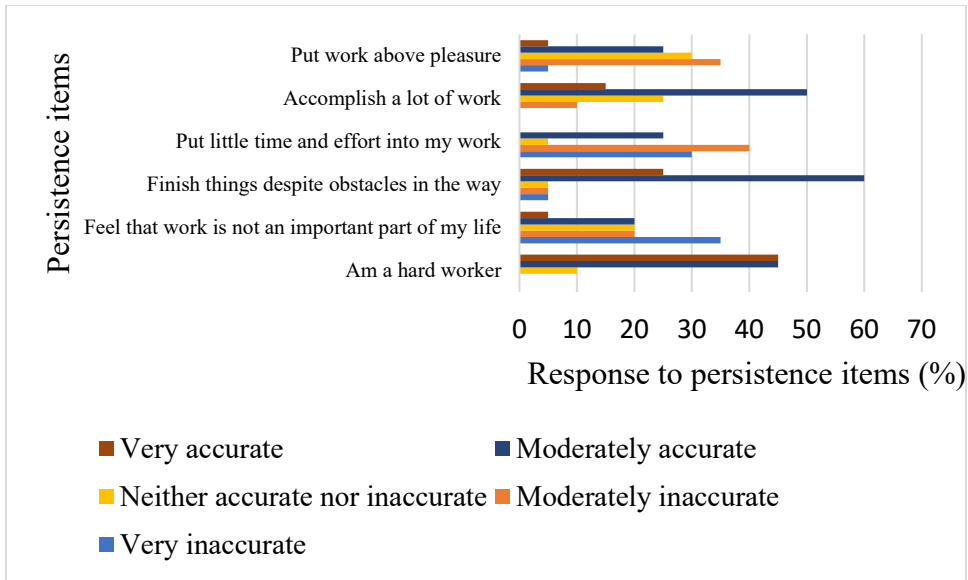


Figure 5. Response to the persistence items (CEM)

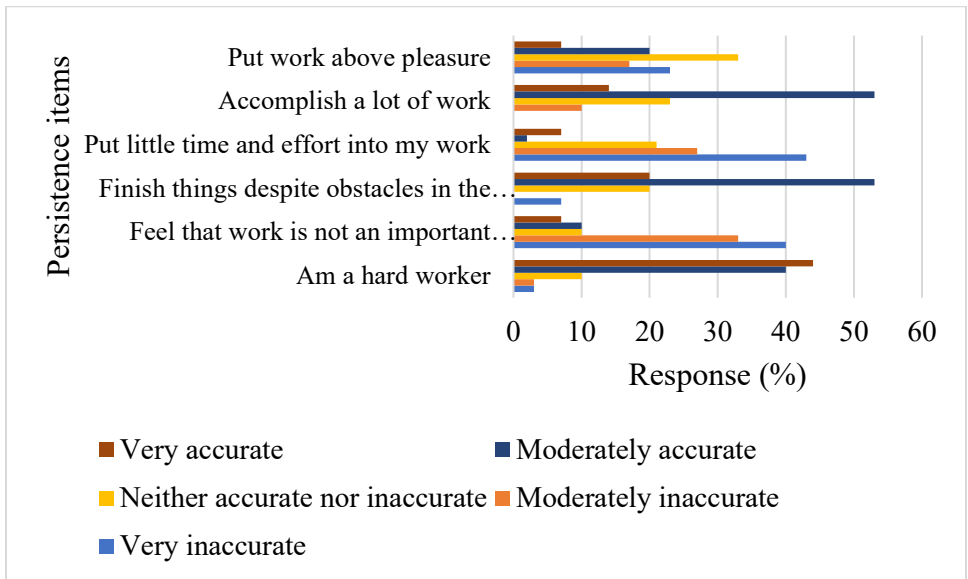


Figure 6. Response to the persistence items (CPS)

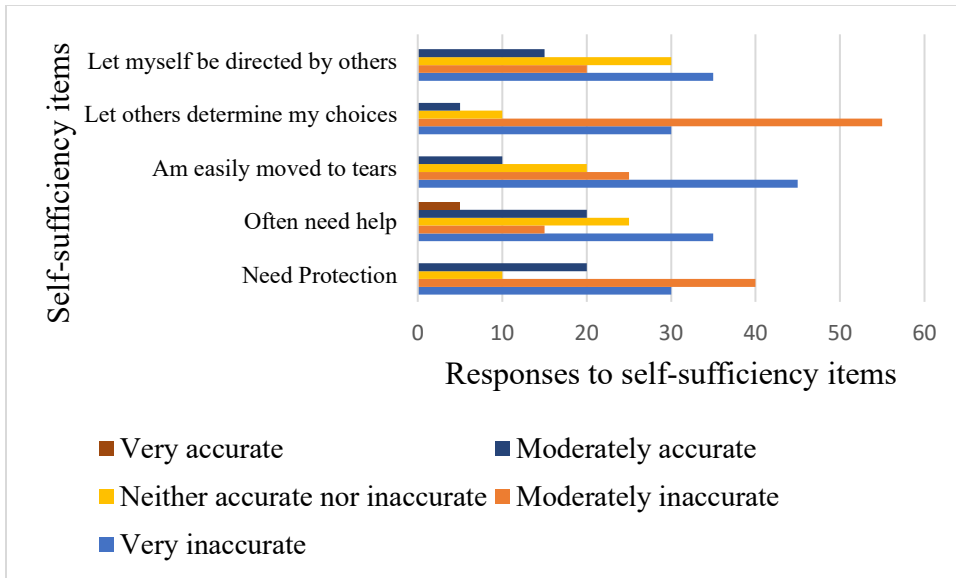


Figure 7. Response to the self-sufficiency items (CEM)

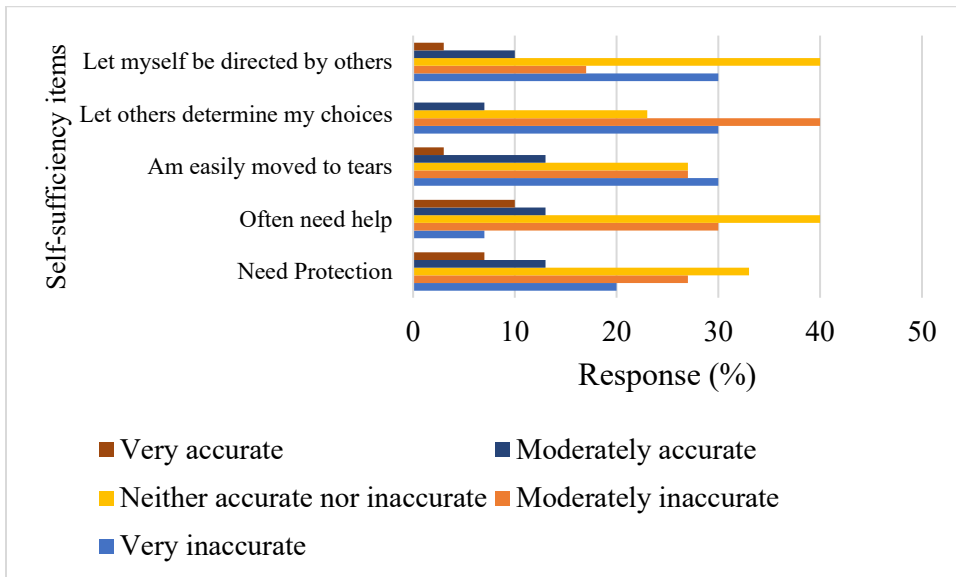


Figure 8. Response to the self-sufficiency items (CPS)



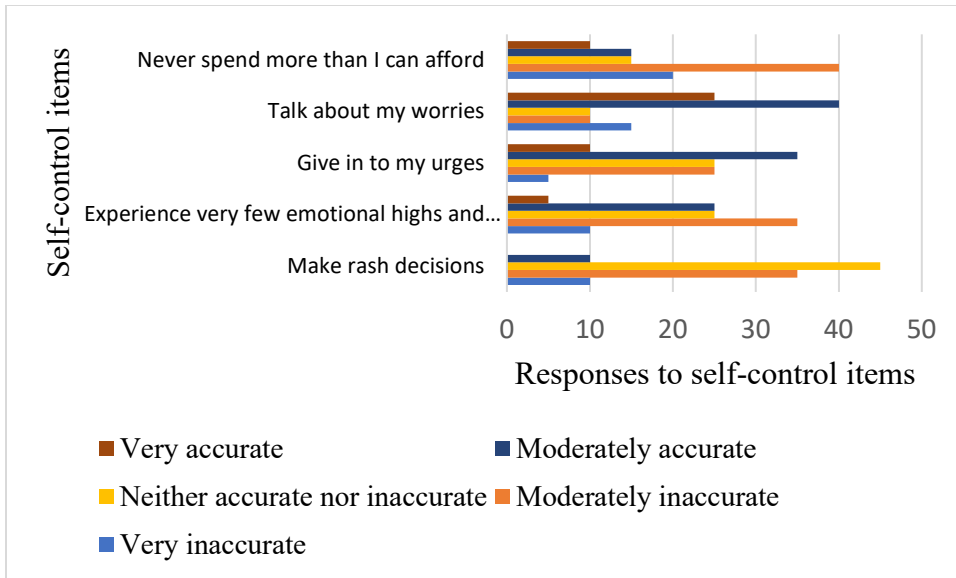


Figure 9. Response to the self-control items (CEM)

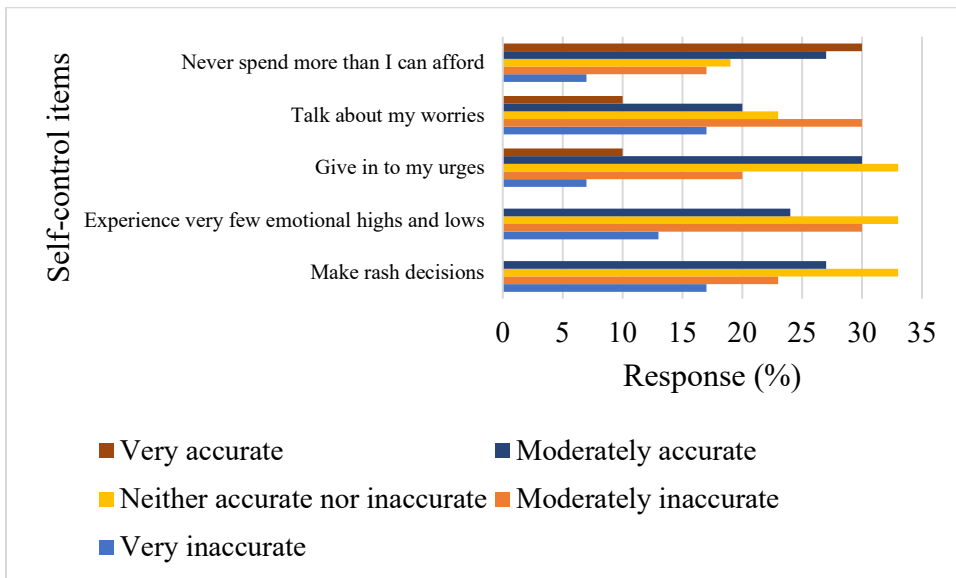


Figure 10. Response to the self-control items (CPS)