

FACTORS AFFECTING LEADERSHIP STATUS IN A STEM-FOCUSED SCHOOL

BACKGROUND

Many STEM students feel they lack the traditional characteristics associated with leadership, which leads them to believe they are not suited for leadership roles. This inspired us to investigate the factors affecting whether students enter leadership boards in a STEM-focused school, as to gain a deeper understanding of what defines an effective leader and evaluate the fairness of the leadership system in this school.

RESEARCH QUESTION

“ How do **personal traits** such as **grade**, **weekly lesson hours**, **leadership style**, and **motivation**, influence membership in a leadership board in 2025? ”

DATA COLLECTION

SAMPLING

We conducted a **binomial test** with **two groups**: individuals with official leadership roles in 2025 and those without. These outcome variables are **mutually exclusive and distinct**.

We conducted the test via **voluntary response** from a total of **81 leaders** and **27 non-leaders**.

SURVEY QUESTIONS

2024 Promo CAP
Numerical Value (to 1 dp) between 0.0 and 5.0

Hours of lesson per week

Leadership style

- Assertive
- Communicative
- Trusting

Valued motivation

- Passion
- Goals (e.g. portfolio)
- Extrinsic motivation

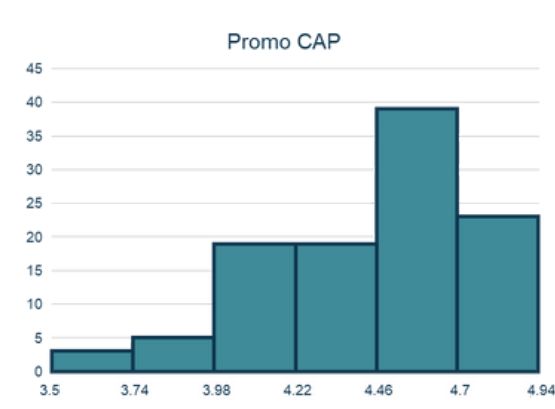
DATA



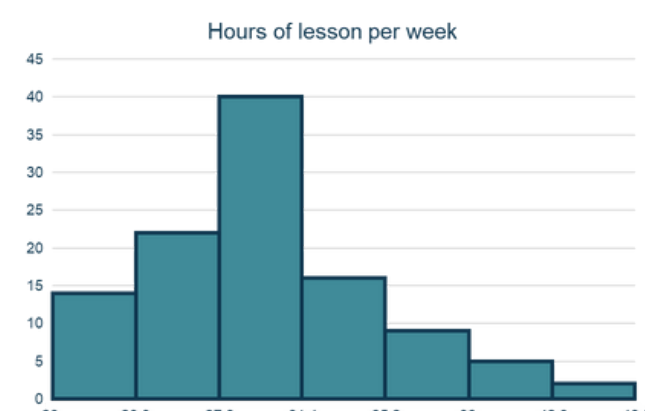
Communicative more common in leaders; Assertive and trusting more common in non-leaders



Goals more common in leaders; passion and extrinsic more common in non-leaders



Promo CAP skewed left



Hours of lesson a week skewed right

LOGISTIC REGRESSION TEST

We conducted the **Binomial Logistic Regression Test** in **Jamovi software**, after **removing outliers** determined using **Cook's distance** and **deviance residuals**.

$$\log\left(\frac{P(Y=1)}{P(Y=0)}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p$$

$$H_0: \beta_0 = \beta_1 = \dots = \beta_p = 0$$

$$H_a: \text{At least one } \beta_i \neq 0$$



Input

Factors

- Leadership style
- Motivation

Covariates

- CAP
- Hours of lesson per week

Dependent variable

- In leadership or not

We carried out the test at **95% confidence level**.

LIMITATIONS & IMPROVEMENTS

Limitations:

- **Not a simple random sample** due to non-response leading to voluntary response bias
- **Mistakes in lists** used to determine sampling frame
- **Confounding variables** present such as **leadership experience, skills and age** that are too complex, hard to quantify and standardise across all boards
- **Unofficial leadership positions not counted** as leadership experience or current leadership roles

TEST ASSUMPTIONS

- ✓ Appropriate Outcome Structure (binary)
- ✓ Observation Independence
- ✓ Large Sample Size
- ✓ Absence of Multicollinearity
- ✓ Linearity of Independent variables and Log Odds



	VIF
Hours of lesson	1.16
Promo CAP	1.10
Leadership style	1.07
What you the value the most?	1.02

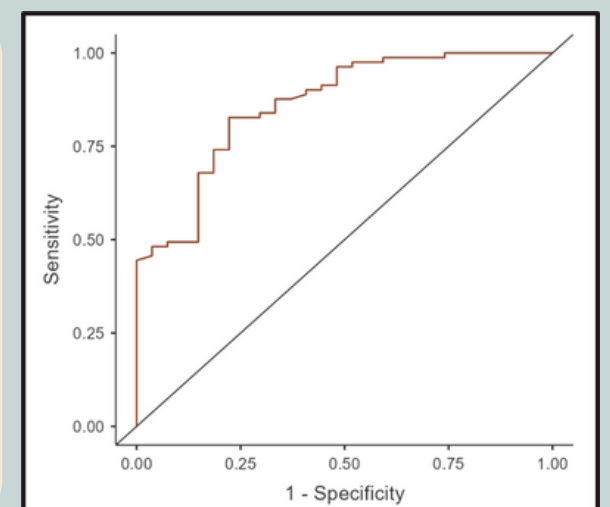
	z	P> z
const	-0.847	0.397
CAP	0.368	0.713
Promo_CAP_in	-0.296	0.767
Hrs	1.212	0.226
Hours_in	-1.262	0.207

RESULTS AND ANALYSIS

Predictor	Estimate	95% Confidence Interval		SE	Z	p
		Lower	Upper			
Intercept	-5.172	-13.4305	3.0857	4.2134	-1.2276	0.220
Hours of lesson	-0.165	-0.2817	-0.0479	0.0596	-2.7637	0.006
Promo CAP	1.948	0.0895	3.8056	0.9480	2.0544	0.040
Leadership style:						
Communicative - Assertive	0.443	-0.9581	1.8448	0.7150	0.6200	0.535
Trusting - Assertive	-1.128	-2.7737	0.5167	0.8394	-1.3444	0.179
What you the value the most?:						
Passion - Extrinsic	2.692	0.8321	4.5510	0.9487	2.8371	0.005
Goal - Extrinsic	21.427	-3783.5546	3826.4093	1941.3530	0.0110	0.991

Note: Estimates represent the log odds of "in leadership? = 1" vs. "in leadership? = 0"

- Predictors "Promo CAP", "Hours of lesson per week" are **significant** at 5% significance level as their P-values < 0.05.
- Leadership style **does not affect** leadership outcome.
- Students who **value passion for leadership over extrinsic motivation** are more likely to hold a leadership role.



Model	Deviance	AIC	R ² _{McF}	Overall Model Test		
				χ ²	df	p
1	80.1	94.1	0.340	41.3	6	<.001

Note: Models estimated using sample size of N=108

Model has good to strong fit

- Deviance < Null Deviance (121.46)
- 0.3 < Pseudo R-squared Macfadden < 0.4

Good classification performance

- High accuracy
- High sensitivity, moderate specificity
- High AUC

Predictive Measures			
Accuracy	Specificity	Sensitivity	AUC
0.833	0.519	0.938	0.862

Note: The cut-off value is set to 0.5

CONCLUSION

As **P value < 0.05** for **variables CAP, Hours of lesson and valued motivation**, we reject H_0 at 5% significance level. There is **sufficient evidence to conclude that:**

A higher CAP, less hours of lesson, and values passion as motivation increases membership in leadership board 2025.

As **P value > 0.05** for **variable leadership style**, we do not reject H_0 at 5% significance level. There is **insufficient evidence to conclude that:**

Different leadership styles influence membership in leadership board 2025.

Higher CAP:

A higher CAP could reflect certain leadership traits, and some boards may have a minimum CAP requirement.

Leadership style:

Due to the diversity of leadership boards, there isn't one best leadership style that promotes membership.

Passion motivation:

Intrinsic motivation can drive students to step up. When one is not passionate, it is unlikely that others will strongly encourage them to join a board. Lack of passion may be an indication of lack of initiative.

Less lessons:

Those with less lesson hours may find more time to participate in other things like leadership. Leaders could also be likely to intentionally prevent overcommitment.

“ **Anyone can be a leader** ”

Improvements:

- **Force people chosen by simple random sample** to fill the survey
- **Ensure lists** are **verified** before using them
- **Matched Pair design** for leaders and non-leaders with the same age to reduce effect of confounding variables
- **Bigger sample size** for non-leaders to increase accuracy of model for them.