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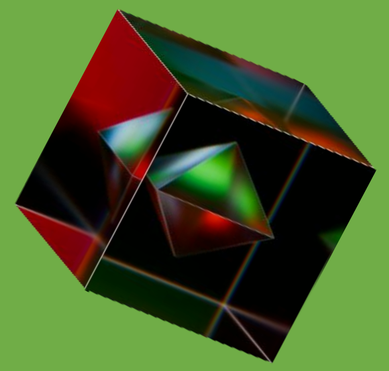


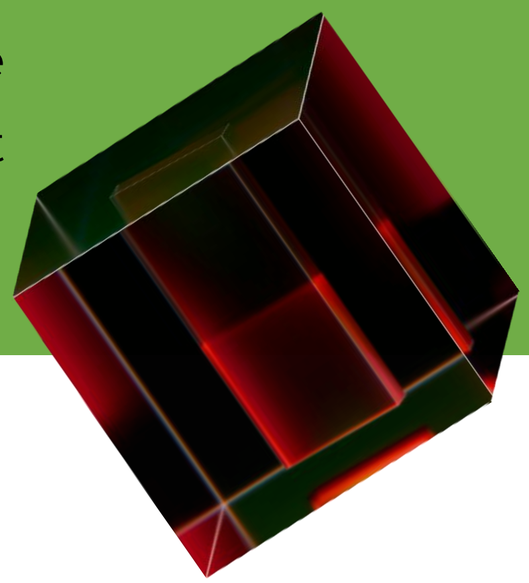
Effect of Paper Airplane Design on Flight Distance

INTRODUCTION

The design of a paper airplane can greatly influence how far it flies, as factors like wing shape, weight distribution, and aerodynamics affect its flight performance.

Understanding these design elements can help predict which configurations maximize distance and stability.

This study aims to compare different paper airplane designs to determine which type achieves the longest flight distance.



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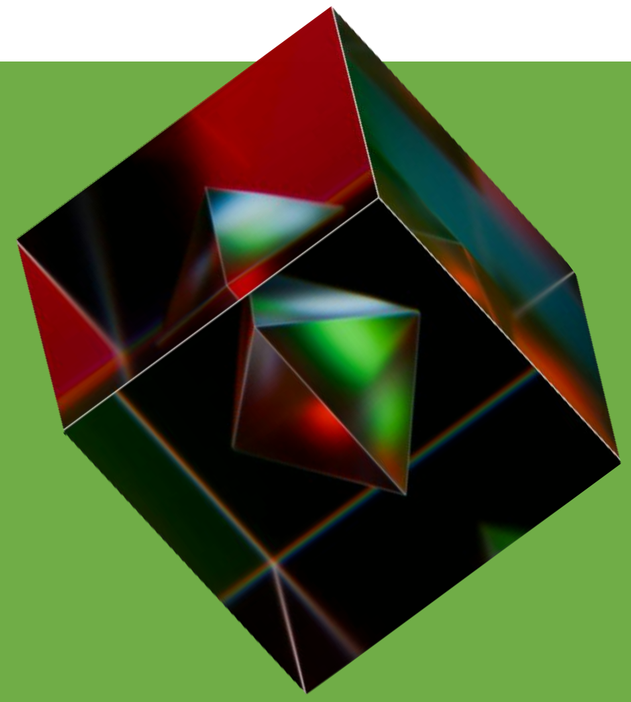
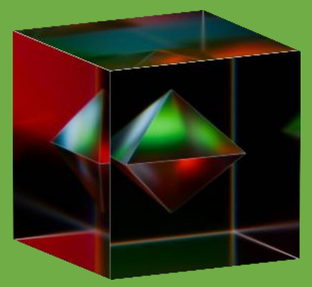
PROBLEM



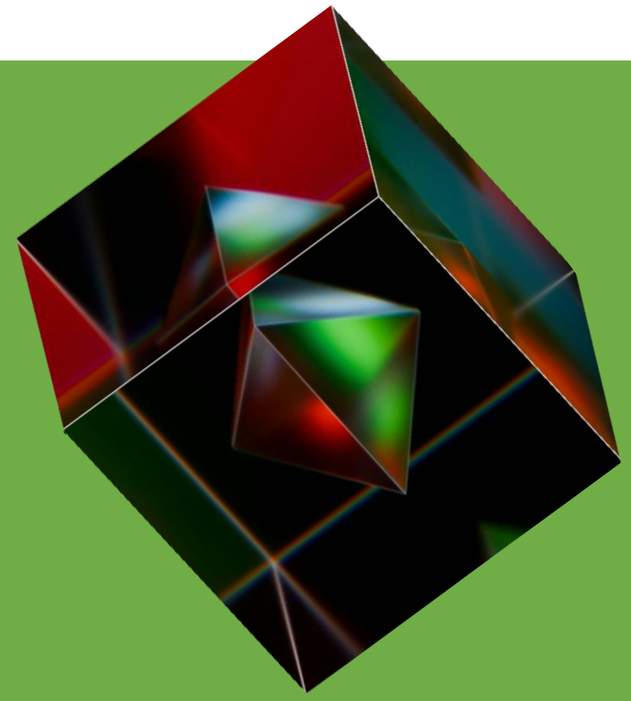
Which of the eight paper airplane designs achieves the greatest flight distance under the same conditions?

BACKGROUND RESEARCH



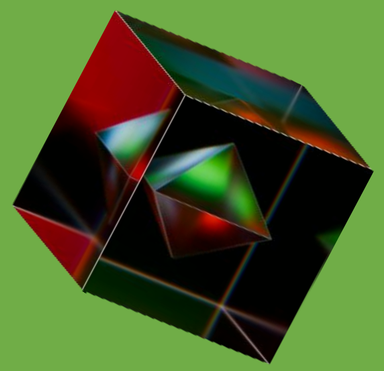
Our science fair project is about how the design of a paper airplane affects its flight distance. According to scientists Leif Ristroph (2023), factors like wing size, shape, and the plane's center of gravity all influence how well it flies. This information helps me understand that bigger wings can increase lift and hang time, while the right amount of weight helps the plane fly straighter and farther. I also learned that making clean, symmetrical folds improves stability and reduces drag. Overall, studying paper airplane design helps me see how different forces work together to affect flight performance.

HYPOTHESIS



A. If the eight paper airplane designs are tested indoors, then the glider will cover the greatest distance because its large wings produce more lift and stable flight in still air.

B. B. If the eight paper airplane designs are tested outdoors, then the dart will cover the greatest distance because its narrow shape reduces air resistance and allows it to fly faster and farther in windy conditions.



MATERIALS

- Standard printer paper (at least 3 sheets, one for each design)
- Ruler (to measure flight distance)
- Measuring tape or a marked-off space (for longer distance measurement)
- Stopwatch (to measure flight time)
- Pen or pencil (to record data)
- Notebook or data sheet (to organize your results)
- Flat, open area to throw the planes safely (like a hallway or gym)
- Optional: Tape (to fix planes if needed), camera or phone (to record flights for review)

METHODOLOGY

1. Prepare Materials and Airplane Designs Gather paper, a ruler, timer, and space to throw the planes. Make 8 different airplane designs, changing features like wing shape, size, or weight.
2. Test the Airplanes Throw each design from the same spot, using the same force and angle. Measure how far each plane flies and time how long it stays in the air.
3. Repeat and Record Test each design multiple times (3 trials). Record the flight distance for every trial, then find the average for each design.
4. Compare and Analyze Look at the average results. Decide which design flew the farthest. Think about what features helped or hurt performance.

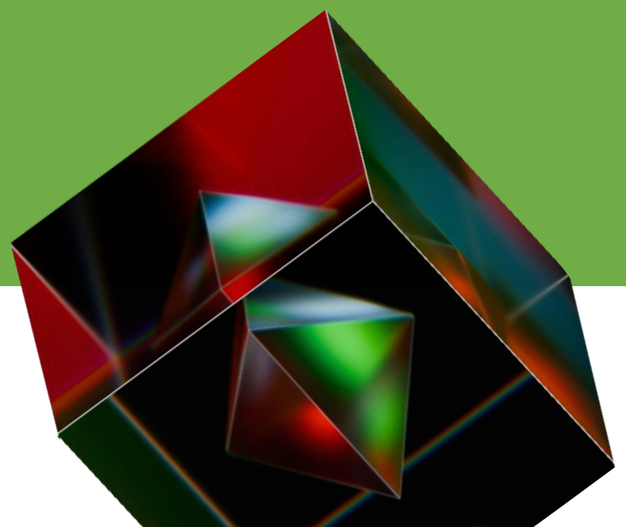
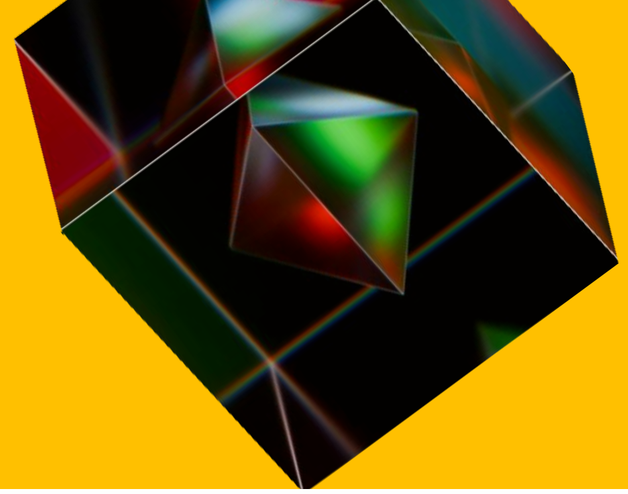


Figure 1. Eight Different Paper Airplane Designs Used in the Experiment. Source: Photo taken by the researchers (2025)



DATA COLLECTION

Figure 2. Data table showing the flight distances of the eight paper airplane designs in indoor and outdoor settings across multiple trials, illustrating differences in performance under varying environmental conditions. Photo taken by the researchers (2025).

TRIALS (INDOOR)	ARROW	DELTA	GLIDER	DART	RAPTOR	CONDOR	CANARD	HEAVY NOSE
TRIAL 1	543 cm	198 cm	876 cm	467 cm	498 cm	167 cm	171 cm	497 cm
TRIAL 2	610 cm	197 cm	520 cm	519 cm	333 cm	223 cm	201 cm	542 cm
TRIAL 3	598 cm	159 cm	480 cm	486 cm	396 cm	231 cm	270 cm	494 cm
AVE	**583 cm**	**184.7 cm**	**625.3 cm**	**490.7 cm**	**409 cm**	**207 cm**	**214 cm**	**511 cm**

TRIALS (OUTDOOR)	ARROW	DELTA	GLIDER	DART	RAPTOR	CONDOR	CANARD	HEAVY NOSE
TRIAL 1	685 cm	317 cm	528 cm	553 cm	520 cm	254 cm	260 cm	623 cm
TRIAL 2	551 cm	409 cm	736 cm	832 cm	571 cm	229 cm	629 cm	604 cm
TRIAL 3	792 cm	322 cm	738 cm	942 cm	520 cm	412 cm	308 cm	608 cm
AVE	**676 cm**	**349.3 cm**	**667.3 cm**	**775.7 cm**	**537 cm**	**298.3 cm**	**399 cm**	**611.7 cm**

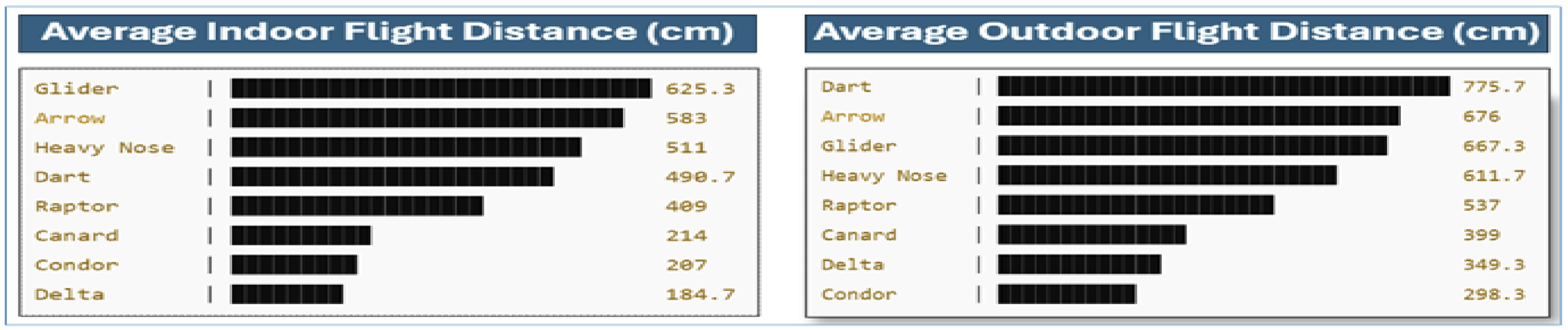
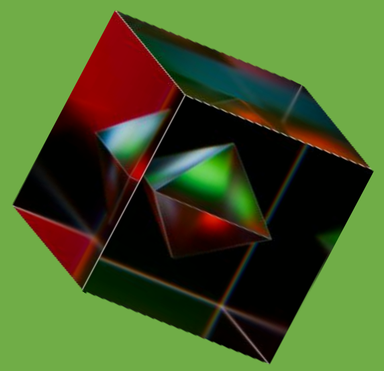


Figure 3. Bar graphs showing the flight distances of the eight paper airplane designs in indoor and outdoor settings across multiple trials, illustrating differences in performance under varying environmental conditions. Photo taken by the researchers (2025).

Indoors, the glider design achieved the greatest average flight distance (625.3 cm). This suggests that the glider's large wings and high lift allowed it to stay airborne longer in still air, increasing its horizontal distance.

Outdoors, the dart design traveled the farthest with an average distance of 775.7 cm. This indicates that the dart's streamlined shape and higher speed made it more effective in outdoor conditions where wind and air resistance play a larger role.

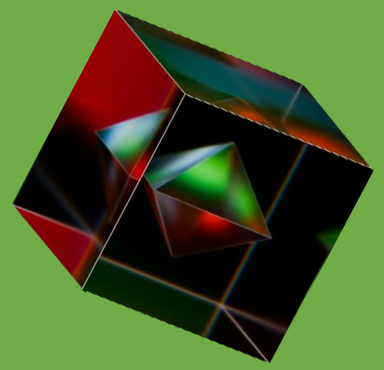
DATA ANALYSIS



VARIABLES

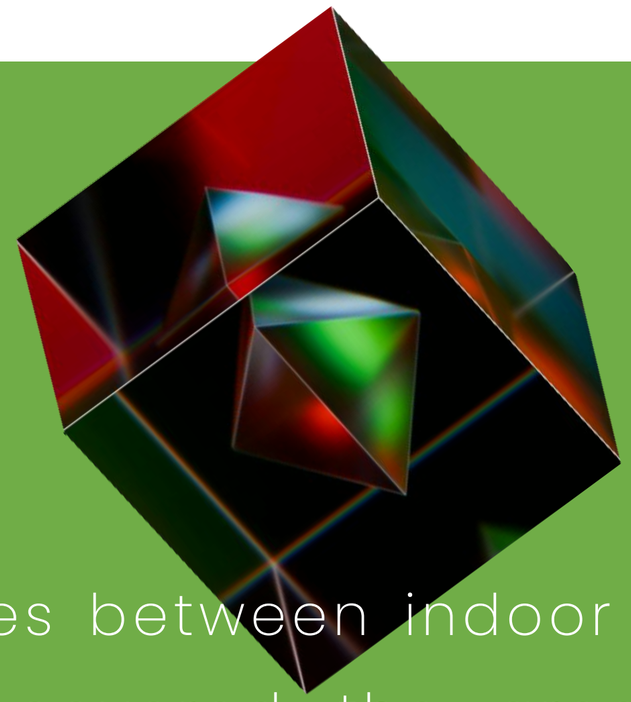
Independent	Dependent	Controlled
Design of Paper Airplanes	Distance Covered by the Paper Airplanes	- Type of Paper - Throwing method - Environment - Starting Point - Number of Throws - Measuring Tool

IMPORTANCE OF THE STUDY



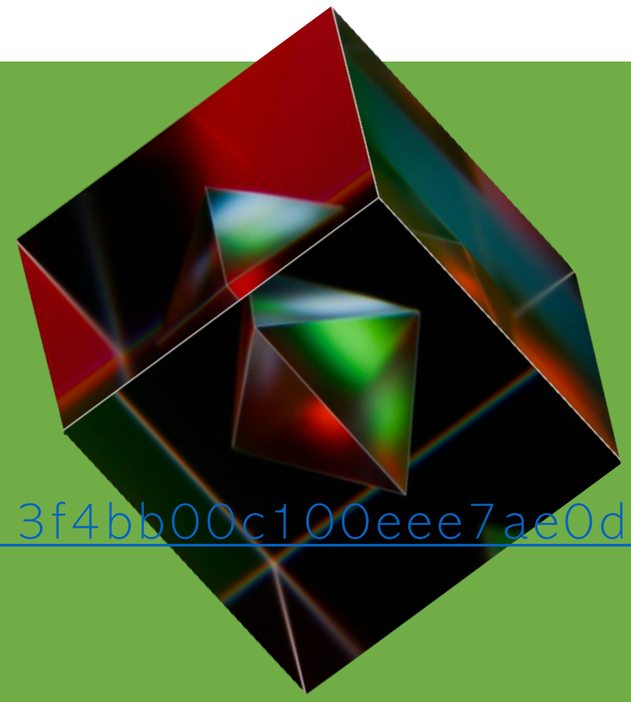
Our study is important because it helps us understand how different designs affect the flight performance of paper airplanes. By learning which shapes fly farther, we can explore principles of aerodynamics, physics, and engineering in a simple, hands-on way.

CONCLUSION



The results show that flight distance varies between indoor and outdoor conditions. Indoors, the glider covered the greatest average distance, indicating that designs with larger wings and greater lift perform best in calm air. Outdoors, the dart covered the greatest average distance, showing that streamlined, low-drag designs travel farther in open and windy conditions. Overall, the experiment demonstrates that lift-focused airplanes are more effective indoors, while speed-focused airplanes are more effective outdoors.

REFERENCES



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