This analysis will evaluate the potential materials for the wheel maze, tic-tac-toe assembly and a planetary gear fidget proposed for an outdoor playground. Factors that must be evaluated before selecting a material are durability, environmental exposure, manufacturability, repeated handling and user safety. This will primarily focus on filaments like PETG and ASA for the 3D-printed components, along with acrylic, plywood, aluminum and fasteners assessed according to their roles. This evaluation will hopefully result in a conclusion for material selections.

	PETG	ASA
Mechanical Behavior	Good Toughness and layer adhesion	Great Impact performance
Sunlight/UV	Can vary	Great for extended UV exposure
Heat Exposure	Possible to soften sooner in hot conditions	Better heat resistance, in general
Printability	Usually easier to deal with in 3D printing	More prone to warping and produces more harmful fumes
Roles	Great for prototyping and good enough for final product	Terrible for prototyping, but great for final product when everything works like it should.

Maze Activity

The maze for the playground will consist of the following: acrylic sheet elements, a 3D printed peg, some sort of wood backing, fasteners, and spacers. For starters, Acrylic provides a smooth, finished surface and comes in different colors. The only drawback to acrylic is the fact that it can be cracked if disrupted hard enough. But its UV resistant properties along with its compatibility for manufacturing make it a perfect cover.

For the physical maze component, PETG and ASA are both outstanding materials. If both have similar surface finishes, then the difference in performance will be negligible. What makes PETG more appealing is its accessibility in prototyping, UV properties, and fundamental structure requirements.

Tic-Tac-Toe Activity

This will feature 3D printed shapes attached to aluminum rods with spacers. Like mentioned before, ASA and PETG are perfect for the 3D printed Pieces due to their UV resistance. However, due to the PETG being more versatile and not emitting an odor in the 3D printing process, it will be the primary choice. The aluminum for rod material is excellent because

aluminum doesn’t corrode when outside. Not to mention, it contains great structure properties for consistent use.

Planetary Gear fidgeting

The planetary style herringbone gears are intended to be printed in either PETG or ASA. Outdoor durability, tooth accuracy, surface finish, and wear are especially important because the teeth engage repeatedly. ASA is a strong initial choice for UV-exposed use, but dimensional consistency and the print process must be checked before doing so. When it comes to similar UV performance and strength, PETG is also a great candidate, but it offers better manufacturing stability and prototyping.

Design

For filament selection, PETG is a great choice for its UV resistant properties, structure, and prototyping versatility. Acrylic, wood and aluminum will also be strong candidates for material selection due to their structural and anti-corrosive properties. From this stage, the team will prototype these selections and see how they do in an actual setting and record the results.

Conclusion