MOSAIC: Visual Narrative Scaffolds for Reading Comprehension and Story Composition

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Figure 1: MOSAIC turns a story into a structured comic. (A) Mr. Davis writes a prompt and picks a genre and length. (B) Word Analysis tags each word with AoA and Concreteness scores and suggests age-appropriate synonyms; Story Breakdown divides the story into sections mapped to Cohn's Visual Narrative Grammar roles. Both are editable. (C) Character descriptions are extracted and rendered as images, updatable by prompt or photo. (D) Each section renders as a comic panel labeled with its narrative role, using verbatim story text. (E) Students reuse the structure to write their own stories.

Abstract

Many autistic children experience reading comprehension difficulties linked to narrative understanding and lexical-semantic knowledge. MOSAIC (Multimodal Organizer for Story Analysis, Imagery and Comprehension) is an authoring tool that turns stories into structured comics to make reading comprehension and composition more accessible. It breaks down a story through a genre-driven narrative grammar and analyzes vocabulary against age-of-acquisition and concreteness norms, letting learners simplify difficult words in place. These scaffolds guide comic generation, preserving the story text while rendering panels aligned to each narrative role. Informal feedback from teachers, parents, and autistic students points to potential uses beyond reading comprehension and composition, including social preparation and creative storytelling.

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1 Introduction

Visual narrative tools have been used to support autistic children's learning by making abstract ideas more concrete and accessible, capitalizing on a visual processing disposition [2, 6, 14]. While effective, these tools are labor-intensive and difficult to personalize to a learner's own stories and interests [5, 13]. Recent advances in generative AI offer a way to reduce this authoring burden: systems such as AutiHero and Autiverse generate comic-based social stories and journaling for autistic users [8, 15]. These tools mainly focus on behavior guidance and self-expression. We adapt AI-powered visual narrative generation to support reading comprehension, a persistent challenge for many autistic children even when decoding and cognitive ability are strong [9]. These difficulties are commonly linked to two factors: difficulty constructing a coherent situation

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Table 1: Genre-specific stage names for each Cohn narrative category.

Cohn Category	Hero's Journey	Rags to Riches	Comedy	Mystery	Coming of Age	Speculative Fiction
Establisher	Setup / Ordinary World	Hero in poverty	Social situation established	Crime discovered	Youthful state	Stable reality introduced
Initial	Call & Commitment	Opportunity appears	Mistake or misunderstanding	Investigation begins	Challenge of adulthood	Anomaly appears
Prolongation	Rising Trials	Trials and growth	Increasing complications	Clues and misdirection	Learning and mistakes	Pattern accumulation
Peak	Climax / Ordeal	Recognition or success	Truth revealed	Culprit revealed	Mature decision	Apparent explanation / twist
Release	Return & Resolution	New life achieved	Harmony restored	Case resolved	New adult identity	Cognitive aftermath

model of a narrative, event sequencing, causal relations, and characters' mental states, and gaps in lexical-semantic knowledge [16].

In this study, we present MOSAIC (Multimodal Organizer for Story Analysis, Imagery and Comprehension), which uses generative AI to create visual narratives while targeting both comprehension drivers. First, it organizes the story with a genre-driven narrative structure that makes key story elements explicit [4]. Second, it provides word-level analysis grounded in age-of-acquisition (AoA) and Concreteness norms to support lexical-semantic understanding [7]. These two layers guide comic generation: MOSAIC preserves the story text verbatim while generating panels aligned with the story's narrative structure. This scaffold also offers an entry point into composition, letting learners begin with small revisions and progress toward authoring their own stories within the same structure [11].

2 System Design

MOSAIC's system is illustrated in Figure 1. The user provides a prompt and selects a genre and story length, and can later author stories directly within the same structured format. We describe the system's main components below.

Narrative Structure. MOSAIC is organized around Cohn's Visual Narrative Grammar [4], which defines five narrative roles: Establisher, Initial, Prolongation, Peak, and Release. Each genre is a fixed sequence of stages, each assigned a Cohn role (Table 1). We prompt GPT-4o mini [10] to generate one story segment per stage, and validate the draft against the genre's expected sequence.

Word Analysis. Each word in the generated story is rated on two published norms: AoA [7] and Concreteness [3]. Words absent from these norms are scored by Claude Sonnet 4.6 [1] using rated words as anchors. In the editor, hovering shows a word's difficulty and clicking suggests simpler alternatives, each re-checked against the norms so replacements are always earlier-acquired. A difficulty chart updates as words are swapped.

Character Extraction and Customization. We prompt Claude Sonnet 4.6 to extract a character description (appearance and distinguishing features), then use Gemini 3.1 Flash to render it, with the first portrait establishing a shared house style for consistency. Users can revise characters by editing the description or uploading a photo, supporting self-insertion and interest-based personalization.

Panel Generation. Panel generation follows the same narrative structure (Section 2.1). GPT-4o mini generates scene directions, camera framing, staging, mood, guided by each panel's narrative role (e.g., Establisher as a wide shot). Gemini 3.1 Flash then renders the panels. Character portraits serve as likeness references across panels, and dialogue appears as speech or thought bubbles.

3 Application of MOSAIC

Through informal feedback from teachers, parents, and autistic students during development, we identified a range of applications for MOSAIC. Its primary use is to support reading comprehension and composition together: MOSAIC scaffolds story-building through an explicit narrative grammar and word-level analysis, while the comics make the text more accessible and engaging.

One account illustrates this potential: a researcher used MOSAIC with an autistic learner who had previously been reluctant to engage with text. After seeing a story broken into its structure, she began composing her own stories within that frame and was eager to see them rendered as comics. Teachers use MOSAIC to build their own lesson stories grounded in students' specific interests, as one teacher described: *"I used to spend a whole summer looking for the perfect book for the perfect lesson, but now I can just create my own."*

Beyond comprehension and composition, feedback pointed to social situations and self-determination. A parent used MOSAIC to prepare their child for social situations, teaching behaviors like taking turns or greeting a classmate, and easing anxiety around events like a first day of school or a field trip by letting them engage with the scenario in advance, via comics. This can help ease the impact of novelty as those on the autism spectrum often have a disproportionate reaction to novelty [2, 12]. One teacher envisioned using MOSAIC for a choose-your-own-adventure activity: the teacher provides the opening structure, and students create different paths and endings. This lets students practice storytelling within a shared scaffold while still making their own creative choices.

4 Conclusion and Future Work

We presented MOSAIC, an authoring tool that turns stories into structured comics through genre-driven narrative organization and word-level vocabulary analysis, targeting two factors linked to reading-comprehension difficulty in autistic children: situation-model construction and lexical-semantic knowledge. Informal feedback suggests the tool may also support composition, social communication, and preparation for new experiences.

Future work will evaluate MOSAIC by comparing text-only and comic-based conditions with comprehension questions ranging from literal to inferential [2]. We will also examine whether MOSAIC's editable structure helps learners revise text and compose their own stories over time. Ongoing development will continue to strengthen privacy and safety protections, including content filtering and safeguards against recognizable intellectual property.

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