Exploring Accessibility Features in SeekBeak: Making 360° Content More Inclusive

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Abstract: Immersive 360° media is changing how educators engage learners in experiences such as virtual field trips, lab simulations, and career-exploration experiences, yet accessibility for learners with disabilities is often an afterthought. This article describes accessibility features built into SeekBeak, a cloud-based platform for authoring interactive 360° content. It shows how they are used in two-year college technician education and K-12 career exploration. These features include keyboard navigation across the full interface, hotspot shortcut keys, joystick and adaptive-controller input, and a tap-and-hold gesture for touch devices. A text viewer that presents hotspot content as structured text that works well with screen readers. The work draws on immersive career-exploration tours produced by Be More Colorful, a Resource Collaborative for Immersive Technologies (RECITE) industry partner, that are deployed across more than 25 states. We map each feature to WCAG and UDL principles.

Keywords: accessibility, 360° Media, immersive learning, extended reality, assistive technology, STEM education

Materials and Methods

SeekBeak is a cloud-based virtual experience creation platform that allows users to build interactive 360° images, virtual tours, and panoramic experiences. This creation can be done without specialized software or advanced technical expertise [1], [2]. Built on WebXR and WebGL, it supports tours that incorporate multimedia content, analytics, and branding [1],[3].

Partner Context and Deployment

SeekBeak works with Be More Colorful, an industry partner of the Resource Collaborative for Immersive Technologies (RECITE). Be More Colorful is an immersive media studio that builds interactive virtual tours of employers and communities. These experiences are designed to help individuals make informed decisions about potential career paths [4], [5], [6]. RECITE is a national, multi-institutional NSF Advanced Technological Education initiative (DUE #s 2331451–2331455, 2534496) [7]. They help two-year colleges bring extended reality (XR) into technician classrooms and develop instructional resources for those programs [8]. Immersive 360° environments can support engagement and the development of complex skills in technical fields [9], [10].

Accessibility features developed within SeekBeak's viewer have been integrated directly into Be More Colorful's CareerViewXR platform, which uses 360° photo and video content to deliver career exploration programming in K-12 schools, CTE centers, and community colleges across more than 25 states.

Accessibility Frameworks Guiding Design

Two complementary accessibility frameworks guided the design choices: the Web Content Accessibility Guidelines (WCAG) and the Universal Design for Learning (UDL). WCAG groups its recommendations into four principles: Perceivable, Operable, Understandable, and Robust. This makes it easier to check whether content can be sensed, used, interpreted, and reliably supported with assistive technologies [11]. UDL focuses on offering multiple ways for learners to engage with content, access and interpret information, and demonstrate what they know [12]. For SeekBeak, accessibility is woven into the platform itself, rather than added as a final compliance step [1],[2],[13]. The collaboration between RECITE and SeekBeak has shaped these features to ensure they work for a broader audience across more use cases. Together, RECITE, SeekBeak, and Be More Colorful used WCAG and UDL as shared reference points in working meetings to identify concrete accessibility opportunities and build them directly into the platform.

Accessibility Features SeekBeak Implemented

A more comprehensive and regularly updated list is provided on SeekBeak's accessibility page [14].

Keyboard navigation. Not everyone who engages with XR content navigates with a mouse, so SeekBeak supports keyboard-only input throughout the interface [2]. In a 360° scene, the arrow keys handle basic tilting and panning, while Shift + arrow keys let users make finer adjustments to the view. Outside the scene, Tab and Shift+Tab move focus through toolbar controls, navigation elements, and thumbnails; Enter or Space activates a control; and Escape closes dialogs. Overlay menus follow the WAI-ARIA menu pattern, and creators can set a custom focus order and assign screen-reader labels without writing code. Together, these layers of keyboard support: scene control, UI navigation, and ARIA-compliant menus provide a comprehensive foundation for operable interactions in a mouse-dominated interface, directly supporting WCAG's "Operable" principle and UDL's call for varied means of navigation and control [11], [13].

Hotspot navigation with shortcuts. Instead of forcing people to sweep around a 360° scene to find each point of interest, SeekBeak lets them use shortcut keys to jump straight from one hotspot to another. This makes it easier to move through dense or complex environments, which is especially helpful for users with motor impairments or anyone who needs quick access to specific content [2], [11].

Joystick support for external controllers. SeekBeak also supports joystick navigation for people who rely on adaptive devices. With external USB, Bluetooth, and Microsoft adaptive controllers, users can explore immersive scenes with a familiar, tactile setup. This opens the platform to a wider range of interaction styles [2], [15]. These alternative input options reflect UDL's call for multiple ways to act on and express understanding in a learning environment [12], [13].

Tap and hold for simplified control. Tap-and-hold is another touch gesture SeekBeak supports. Instead of requiring users to tap a small target and then drag precisely, they can press and hold to trigger the same action. For people with limited fine motor control, this small change makes a real difference in whether the platform is usable on a phone or tablet [2].

Text viewer for structured, sequential reading. SeekBeak's Text Viewer feature puts all hotspot content into a simple, organized text format. It uses clear headings and a logical reading order [2]. This structured, sequential presentation makes it easier for screen reader users and others who benefit from text-based navigation to move through virtual tour scenes without relying solely on visual cues.

Device Compatibility and Performance

SeekBeak keeps file sizes small so scenes load quickly. Unfortunately, complex 360° and 3D experiences can still push the limits on some devices [2]. The team continues to tune performance so that accessibility

features and interactivity do not come at the expense of basic usability across a wide range of hardware [3], [11]. Because SeekBeak is browser-based, it works on the vast majority of devices that run popular browsers such as Chrome, Safari, and Firefox. This includes desktops, laptops, kiosks, tablets, mobile phones, and headsets. With keyboard accessibility available wherever a real or virtual keyboard is present. XR/VR headsets using built-in browsers have full functionality in normal browsing mode. Self-contained headsets that use the WebXR "Immersive mode" cannot display HTML content as of mid-2026, so functionality there is limited to basic navigation.

Development and Evaluation Approach

These accessibility features grew out of working meetings between RECITE, Be More Colorful, and SeekBeak. The teams identified concrete opportunities to integrate accessibility into the platform and used WCAG and UDL guidelines as reference points for design decisions. Instead of conducting a pilot or discrete research study, accessibility was embedded in a way that ensures it works for SeekBeak and Be More Colorful clients, including education and workforce development applications. With that in mind, no formal evaluation plan has been designed for this work, as it was an effort to support SeekBeak and Be More Colorful in moving to more accessible products overall. Formal evaluation with learners, including learners with disabilities, at RECITE partner colleges is a natural next step for this work.

Results

Table 1 summarizes how key SeekBeak accessibility features align with the WCAG principles and UDL guidelines.

Table 1. SeekBeak feature to WCAG/UDL mapping

Accessibility Feature	Relevant WCAG Principles & Success Criteria	Relevant UDL Principles
Keyboard navigation	Operable**:** 2.1.1 Keyboard**,** 2.1.2 No keyboard trap**,** 2.4.3 Focus order	• Action & Expression: Options for interaction • Engagement: Options for sustaining effort and persistence
Hotspot navigation with shortcuts	Operable: 2.4.1 Bypass blocks**,** 2.4.5 Multiple ways	• Action & Expression: Options for interaction • Engagement: Options for sustaining effort and persistence
Joystick support for external controllers	Robust: Support for assistive technologies	• Action & Expression: Options for interaction • Engagement: Options for sustaining effort and persistence
Tap-and-hold gesture for simplified control	Operable: 2.5.1 Pointer gestures, 2.5.2 Pointer cancellation	• Action & Expression: Options for interaction • Engagement: Options to sustain effort and persistence
Text Viewer for structured, sequential reading	Perceivable and Operable: 1.3.1 Info and relationships**,** 1.3.2 Meaningful sequence**,** 2.4.6 Headings and labels	• Representation: Options for perception and Options for language and symbols

Schools often deliver CareerViewXR content through VR headsets, which can introduce barriers tied to end-user ability, hardware cost, and classroom management. Web-optimized versions that use SeekBeak's accessibility features allow end users to access the same content on any internet-connected device with their preferred input method. The next phase will move the team from building features to putting them in front of real users. Testing with learners at partner two-year colleges, including learners with disabilities, will help refine how these features work in practice and shape a follow-up report.

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