How Audio-visual Textbook Publishing Should Respond to Post-Flash Print Editions

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Abstract

As Flash technology gradually exits the mainstream and HTML5 technology rapidly gains popularity as a new trend, publishers of audio-visual teaching materials face the challenges and opportunities of transforming and upgrading their medium from optical discs to the network, and need to make strategic decisions.

Full Text

How Audio-Visual Textbook Publishing Should Respond to the Exit of Flash

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Abstract: As Flash technology gradually exits the mainstream and HTML5 technology rapidly becomes the new standard, audio-visual textbook publishers face both challenges and opportunities in transforming their delivery medium from optical discs to internet-based platforms, requiring decisive strategic action.

Keywords: Flash; HTML5; audio-visual textbooks; publishing transformation

In the fourth quarter of 2020, mainstream domestic internet media widely reported that Adobe had confirmed it would end support for Flash Player by the end of December 2020 [1]. Additionally, Adobe planned to discontinue the Flash Player plugin, which was previously included in browsers such as Microsoft Edge, Google Chrome, and Firefox. On October 26, 2020, Microsoft published a new Windows 10-focused update—KB4577586—in its official update catalog, with the key phrase in the title being "Update for the removal of Adobe Flash Player"

[2]. This corroborated Microsoft' s earlier announcement that the next Windows 10 update would permanently discontinue Flash Player. After Google officially announced the cessation of Flash updates, the Chrome browser also completely removed Flash support, replacing it with HTML5 on the Web [3]. These developments objectively confirm that the 2017 decision by Adobe, Microsoft, Google, and other industry leaders to terminate Flash [4] is being executed according to plan, making Flash' s exit from the historical stage a settled matter.

1. Flash' s Inherent Limitations

1.1 Security Vulnerabilities

Flash is powerful with its own compiler and possesses greater permissions than JavaScript, which is strictly limited by browser sandboxes. Flash can call numerous local permissions, such as opening files, saving and reading local data, and even executing batch or executable files to shut down computers or run other processes. This makes it relatively easy for hackers to attack through Flash vulnerabilities (according to statistics, Adobe Flash plugins revealed 316 vulnerabilities in 2015, averaging nearly six per week [6]). Flash's backward compatibility also introduces additional security vulnerabilities, making it difficult for the technology to completely avoid these issues. In April 2010, Steve Jobs published an open letter titled "Thoughts on Flash," announcing that iPhone would never support Flash, citing security issues, touch interaction problems, poor performance, and high power consumption—this letter remains posted on Apple' s official website [7].

1.2 Weak Cross-Platform Capability

Flash content requires browser support for Flash or requires users to pre-install the Flash Player plugin to view content. This dependency on the Flash Player results in poor portability and is not conducive to cross-platform use, inadvertently raising the barrier to accessing content. The Flash Player' s numerous security vulnerabilities require frequent updates, creating inconvenience and drawing criticism from users, leading to declining user acceptance. When iOS and Android, the two major smart terminal operating systems, announced they would no longer support Flash, the inability of Flash-based websites to display properly on smart terminals became a significant disadvantage. Additionally, if content is embedded in Flash, most search engines cannot index it, causing Flash websites to rank lower in search results and reducing user visits.

1.3 Power Consumption and Touch Interaction Issues

Flash uses vector graphics operations, which consume relatively more power during operation, particularly noticeable on mobile smart terminals. Since most websites embed Flash advertisements, browsing webpages on smart terminals increases battery consumption by a certain percentage. In contrast, HTML5-based video playback can more effectively utilize smart terminal hardware re-

sources, and HTML5 pages have almost no advertisements, so adopting HTML5 can significantly reduce CPU computation and power consumption during web browsing. Flash applications are typically mouse-based and do not support touch well. As mobile smart terminals demand increasingly sophisticated interaction, Flash's touch performance can no longer meet higher requirements. With the popularization of 5G mobile internet and home fiber broadband in China, Flash' s advantage of low bandwidth requirements has gradually disappeared.

2. HTML5' s Advantages

HTML5 (HyperText Markup Language 5) is a language description method for building Web content and represents the most significant leap in Web standards in the past decade. The HTML5 technical standard was officially released in 2008, continuing relevant standards from HTML4 while innovating according to new-generation internet development requirements, with a stable version formed in 2012 [9]. HTML5 not only represents Web content but also brings the Web into a mature application platform where audio, video, animation, and interaction between mobile and PC terminals are all standardized. HTML5' s syntax features are distinct and incorporate SVG content, enabling more convenient handling of multimedia content in webpages and making it easier to replace Flash.

2.1 Cross-Platform, Multi-Device Support

HTML5 was developed through collaboration among hundreds of companies including Apple, Google, Nokia, and China Mobile, with W3C recommendation as its greatest advantage—being an open technology where every public standard can be traced through W3C documentation. W3C-approved HTML5 standards mean that mainstream browsers and platforms internationally will implement them [10]. The advantage of multi-device cross-platform support is first reflected in responsive web design: the same webpage automatically adapts to different screen sizes, automatically adjusting layout according to mobile terminal screen dimensions—precisely where Flash-based web construction falls short. HTML5-developed games can be easily ported to platforms like UC, Opera, and Facebook, and even published to app stores through encapsulation technology, fully demonstrating strong cross-platform capabilities.

2.2 Good Stability

The biggest problem with Flash Player is its tendency to crash, with most users having experienced Flash Player issues when playing games or watching videos. HTML5 uses the Video tag, allowing developers to add video to webpages as simply as adding images. Popular HTML5 video players such as VideoJS, Kaltura HTML5, and FlareVideo are free, open-source, support full-screen playback, and can automatically switch to Flash playback in unsupported browsers. HTML5 video playback utilizes built-in browser functions without requiring any plugins,

making it much more stable than Flash Player. It should be noted that Microsoft IE8.0 and below do not support HTML5, and Windows XP only supports up to IE8, so in some underdeveloped regions where many PCs still run Windows XP, promoting HTML5-based applications is temporarily inappropriate.

2.3 SEO-Friendly and Highly Interactive

Search Engine Optimization (SEO) is a technology that analyzes ranking rules of various search engines and uses more search-friendly methods to optimize developed websites or applications, improving natural search rankings, increasing website traffic, and enhancing commercial value. Websites built with HTML5 allow search engine spiders to more easily crawl and index their content, including all content embedded in animations. In terms of SEO friendliness, HTML5 has clear advantages over Flash. HTML5 also enhances Web page performance and adds Web application functions such as local databases, providing users with more interactive functional experiences.

3. Strategies for Traditional Audio-Visual Textbook Publishers

Currently, most textbook companion discs in China use Flash technology to develop digital educational resources. If we view the disc or discless PC client as a container, then Flash-developed digital resources are encapsulated within it, with the traditional approach being playback through the Flash Player installed in PC browsers.

As a participant in textbook companion disc publishing, the author organized localized Flash usability tests on companion discs and PC clients for relevant school grades in the fourth quarter of 2020. The testing method involved sampling Windows 10 operating systems, installing the latest KB4577586 system patch, manually adjusting the system time to after January 13, 2021, and testing whether Flash resource content on discs and PC clients could still operate normally. Results showed that newer product versions were basically unaffected by this patch, while older versions could not display properly after installation.

Faced with the reality that mainstream browsers no longer support Flash, textbook companion disc publishing institutions urgently need to take measures to ensure normal use for the vast number of users:

3.1 Embedding Players in Discs

In the scenario described above, within the independent container of a disc or discless PC client, newer product versions encapsulate the Flash Player so that the running environment of the disc or PC client includes its own Flash Player, no longer calling on the browser' s Flash Player, thereby ensuring complete presentation of digital resources within the disc or PC client. Newer products use the latest .exe launcher (start.exe), which already includes Flash dependencies

and a built-in Flash launcher (Index.swf), allowing normal playback even when the system browser does not support Flash.

Older product versions require similar optimization. Technically, this can be achieved by updating launcher files and adding independent players (not dependent on system environment Flash) to enable discs to operate normally under new patch environments. The author organized optimization of older products, and after testing, they can now operate normally under new patch environments.

3.2 Transitioning from Discs to the Web

The second path is to reconstruct original Flash-developed resources using native HTML5 development to meet the needs of digital educational resources for cross-platform, multi-device presentation. The author conducted a preliminary analysis of the costs required for HTML5 reconstruction of textbook companion digital educational resources. After consulting with over three professional content providers, based on feedback, quotes vary significantly depending on subject and requirements. For example, physics requires specific evaluation based on experimental forms, live-action scripts, H5 animation, and interaction levels. Overall analysis shows that for single-volume companion HTML5 digital educational resources across subjects from elementary to high school, initial development averages 100,000–180,000 RMB, slightly higher than initial Flash development costs. However, HTML5 revision costs are far lower than Flash. The reasons for these cost differences are: HTML5 development has higher barriers to entry, and its development characteristic is that modifying a single e-book chapter does not affect the entire book. In contrast, Flash has lower development difficulty and less demanding programmer requirements, but its development approach is layer-upon-layer, where local revisions affect the whole, making initial development and subsequent maintenance costs significantly different.

Some professionals have proposed converting existing Flash to HTML5 format to substantially save costs. Professional content providers have conducted related tests, using decompilation to extract UI resources, audio, and video resources from Flash, then using existing conversion tools for conversion, retesting, checking, and modifying before use. This conversion approach has low efficiency, frequently encounters mobile incompatibility issues after format conversion, and makes it inconvenient to modify materials afterward. Single code modifications are also prone to errors, and after conversion, resources can only be used as a complete one-time package, losing update and iteration value. The industry has essentially rejected this approach.

In summary, adopting HTML5 reconstruction to solve Flash' s crisis requires substantial investment. Coupled with the need to simultaneously optimize publishing platforms after HTML5 resource optimization, preliminary estimates suggest a provincial audio-visual textbook publishing unit would need to invest several million RMB. Due to the large investment amount, small and medium-

sized publishing institutions may find it difficult to make such decisions.

The Ministry of Education's Office issued the "Notice on Printing and Distributing the 2019 Catalog of Teaching Materials for Primary and Secondary Schools" [Document No. 3], which explicitly states: "Encourage textbook publishing units to provide digital audio-visual materials supporting textbooks through internet download methods free of charge" [11]. This notice provides policy support for traditional electronic audio-visual textbooks to transform and integrate with the internet.

As the information technology revolution continues to advance, optical discs as traditional audio-visual carriers can no longer meet the needs of educational modernization. Although discs have certain advantages in content security and playback in offline environments, after educational resources are fully integrated with the internet (referred to as "web"), the web demonstrates incomparable advantages over disc carriers in terms of dissemination speed and coverage, smart terminal support and user interaction, timely content updates and learning convenience, and intelligent assessment and personalized learning. HTML5 is a powerful tool provided for the further flourishing of the web. At this moment, choosing between HTML5 and Flash to build digital educational resources essentially means choosing between web and disc to solve future problems. The author believes that traditional audio-visual textbook publishing units urgently need to implement transformation and upgrading from disc to web, so that when the disc window period ends, the web can smoothly take over original disc business. Walking on the path of joint exploration with national audio-visual textbook publishing units, we look forward to achieving high-quality development.

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Note: Figure translations are in progress. See original paper for figures.