

Typical Functions of Digital Textbooks and their Verification

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The authors are interested in what functions are needed to digital textbooks, browsed and operated with use of laptop or tablet PCs. So we extracted them by checking preceding researches and giving questionnaires to various types of stakeholders. The result functions were summarized in 52 items, classified into 7 categories of “authentication”, “copyright”, “contents representation”, “related information”, “additional information by learners”, “learning support”, and “restriction of contents and platforms”. The result is shown in the table below.

The authors also tried to implement these functions on ePub3 format e-book (some are under developing), and verified the operations on 6 ePub reader software. However, many of them did not work on various ePub readers and devices, as shown in the right hand of the table. Major problems belong to insufficient functions of ePub reader software, e.g. they (1) do not permit JavaScript actions, (2) do not permit data transmission to external servers with use of WebAPI, and (3) do not assume data addition (note, underline, etc.) to ePub contents. In order to utilize ePub format as a digital textbook, some functional expansions are needed, and also major function should be added to ePub reader software. Furthermore, stakeholders of digital textbooks (country / regional government, publishers, teachers, administrators, facilitators etc.) should reach the agreement of common functions required to digital textbooks, as shown in the table.

Marks in the table means:

- “O” shows that it works.
- “Δ” shows that it partially works.
- “X” shows that it does not work.
- “TBE” shows that the authors could not find the working implementation way.

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Category	#	Item	Additional description	ibooks3/ iPad2	Himawari Reader/ Android	eBook Reader/ Android	Kindle reader / Kindle	Readium/ Windows	Calibre/ Windows
Authen- tication	1	Authentication (enrollment) of LMS	LMS checks whether an e-Textbook user is registered on LMS.	TBE	TBE	TBE	TBE	TBE	TBE
	2	Online authentication	A publisher checks if an user is authorized to use, when connected to Internet.	TBE	TBE	TBE	TBE	TBE	TBE
	3	Offline authentication	A publisher checks if a user is authorized to use, even when not connected to Internet.	TBE	TBE	TBE	TBE	TBE	TBE
Copy- right	4	Digital right management	e-Textbook file or including content is protected from unauthorized copy. (Social DRM or Commercial DRM)	Δ	Δ	Δ	Δ	Δ	Δ
	5	Usage restriction in case of copyright violation	Prevent representation or operation of body text, media, or screen image in case of copyright violation.	X	Δ	Δ	O	X	X
Contents Repre- sentation	6	Text size arrangement	An user is able to change font size of the body text.	O	O	O	O	O	O
	7	Language specific text representation	Vertical writing, ruby, hyphenation, vertical writing, etc.	O	O	Δ	X	O	Δ
	8	Table support	Representing <table> tagged table.	O	O	X	O	O	O
	9	Multimedia replay (picture, movie, 3D)	To replay various types of multi-media. 3D may vary in 3D-TV, QuickTime-VR,	O	O	Δ	Δ	O	Δ

		or VRML							
	10	Audio replay	Audio file format may vary in MP3, WMA, or QuickTime.	O	O	X	X	O	O
	11	Interactive media operation	Quiz judgment, hide/display selection, and input form processing processed inside e-Textbook.	O	O	X	X	O	O
	12	Page movement	Next, previous, or to specify page number.	O	Δ	X	O	Δ	O
	13	TOC, move from TOC to Target Page	Table of Contents	O	O	O	O	O	O
	14	Footnote, move from Body Text to Footnote	Page-wise or section-wise footnote may vary.	Δ	Δ	Δ	Δ	Δ	Δ
	15	Word index, move from/to body text and index	--	Δ	Δ	Δ	Δ	Δ	Δ
	16	Search text	--	O	X	O	Δ	X	O
	17	Print page	--	X	X	X	X	X	O
	18	Copy text	--	O	X	X	X	O	O
Related Information	19	Dictionary, linkage from/to body text	--	O	X	X	O	Δ	O
	20	References books, linkage from/to body text	--	X	O	X	X	O	X
	21	Selection of reference books	In case a learner has option of References, he is able to specify the choice.	TBE	TBE	TBE	TBE	TBE	TBE
	22	Linkage to Web pages	--	O	O	O	O	O	O
Added Information by Learners	23	Note to add, modify, delete, and move to body text	Note is a text that a learner writes some description to specific part of e-textbook (linkage to body text). (Notes of iBooks has specific meaning)	O	X	X	Δ	Δ	X
	24	Include picture in note	Allow hand-writing note. It is important for pupils.	Δ	X	X	X	Δ	X
	25	Note windows to move and resize	--	X	X	X	X	Δ	Δ
	26	Search text in note	--	O	X	X	X	X	X
	27	Print note	--	O	X	X	X	X	X
	28	Add and delete linkage to references	--	O	X	O	O	X	O
	29	Bookmark to add, index, delete, or move to body text	Option of multiple bookmarks on one e-textbook.	O	X	O	O	X	O
	30	Add and delete underline and highlight	Underline and highlight is put to body text of e-Textbook.	O	X	O	O	X	X
	31	Add and delete linkage to Web	--	X	X	X	X	X	X
	32	Add, replay and delete audio memo	Function to record one's voice as audio memo.	X	X	X	X	X	X
	33	Index of added information	--	Δ	X	Δ	O	X	Δ
34	Timestamp of added information	--	Δ	X	X	X	X	X	
Learning Support	35	Data transfer to server	Automatic or manual.	O	O	X	X	O	O
	36	User specified Window configuration	Includes window separation (like HTML <frame>) and configuration saving.	X	X	X	Δ	Δ	Δ
	37	Sensor data utilization in tablet PC	Touch, acceleration, inclination, GPS, camera etc.	O	X	X	X	Δ	X
	38	Link or call another application	iBooks: URL Scheme	Δ	X	X	X	X	X
	39	Screen image capture	--	O	O	O	X	O	O
	40	Automatic or manual update of eText contents	Teachers, administration, or learners are able to select automatic or manual.	TBE	TBE	TBE	TBE	TBE	TBE

	41	Notice Board	Information bulletin board from teachers and schools. No update by learners. Many options of implementation: Web based bulletin board, push notification, etc.	TBE	TBE	TBE	TBE	TBE	TBE
	42	Discussion Board	For collaborative learning or active learning by learners. Learners are allowed to write, update and delete it.	O	O	X	X	O	O
	43	Q&A Board	--	O	O	X	X	O	O
	44	Time Table	Schedule of learner classes.	O	O	X	X	O	O
	45	Automatic Judgment of Quiz	(Overlapped with #11)	O	O	X	X	O	O
	46	Study History Management	Either a teacher or a learner is able to review learning history. It is used for grading for a teacher, or self-management for a learner.	TBE	TBE	TBE	TBE	TBE	TBE
	47	Database Management	Name list of a class is able to manage on LMS or management server.	TBE	TBE	TBE	TBE	TBE	TBE
Restriction of Contents and Platform	48	File Format	e-Textbook file is by de facto or de jure standard.	O	O	O	Δ	O	O
	49	Size and Weight	Using equipment (laptop or tablet PC) fits a user's capacity in weight and size.	O	O	O	O	--	--
	50	Battery	Battery capacity is enough for all-day learning activity	O	O	O	O	--	--
	51	User Interface	User-friendly Human Interface. E.g. easy power-on or power-down. Vertical writing support (overlapped with #7).	O	O	O	Δ	--	--
	52	Network	PC is connected to network.	O	O	O	O	O	O