



# Wikibooks in higher education: Empowerment through online distributed collaboration

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## Abstract

In this case study, wiki technology was applied to the development of an introductory academic textbook on information systems. While the development, production and distribution of traditional textbooks are influenced by commercial interests, the wikitextbook was developed collaboratively by faculty and by students, and was made available online free of charge. After about two years of activity, the wikitextbook accumulated 564 sub-chapters, co-authored by undergraduate and graduate students in more than 20 classes offered by seven academic departments across three Israeli universities. We discuss the potential of wikitextbooks as vehicles of empowerment to students, teachers, and the discipline. This type of collaborative online technology intimates an influence on the status quo in academic education in favor of less empowered stakeholders. However, caution is advised in drawing premature conclusions from results reported here. The implementation of wikitextbook should be augmented by a careful study of cultural, societal, behavioral and pedagogic variables. © 2008 Elsevier Ltd. All rights reserved.

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## 1. Introduction

This paper is about the incorporation of wiki technology as an alternative platform for textbooks. We discuss the role wikis may play in alleviating some of the drawbacks of the

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traditional textbooks and of the methods of higher education predicated on the commercial publisher controlling the textbook. We suggest that the introduction of wiki-based textbooks disrupt the power relations and value chain in production, ordering and maintenance of curricular material. This disruption leads to a potential empowerment of both teachers and students, as well as of the discipline's community, leading to a better curriculum. We describe an experiment of the implementation of one college-level textbook converted to an online wiki and used by numerous students in multiple classes across several universities. The results of the case study hint at some potential empowerment outcomes. We conclude by suggesting the limitations of this initial attempt, and outline further steps in exploring the potential.

### *1.1. Academic textbooks*

Academic textbooks serve as both a core component and a centralizing force in academic education. Educators use textbooks as sources of knowledge, of illustrations and of exercises. Disciplines use textbooks as the canonical repositories and vehicles for ontological definition. Textbooks epitomize the discipline's dogma and paradigms, and are tools of perpetuating these to the next generation of students (Myers, 1992; Shapin, 1995). Textbooks are also influenced by powerful economic forces. The textbook market is dominated by publishers, many of which are for-profit entities, with a significant vested interest in the promotion of their product, and with maintaining and increasing market share in a competitive industry. Academic textbooks are expensive, with prices continuously and rapidly on the rise (NACS, 2007; Pressler, 2004). The nefarious impact of commercial interests on educational systems is best exemplified in the K-12 textbook market, where centralization, consolidation and market forces have led to homogenous textbooks aimed at a lowest common denominator (Benkler, 2005).

### *1.2. Electronic textbooks*

An electronic book (or e-book) is "a book composed in or converted to digital format for display on a computer screen or handheld device" (Merriam-Webster, 2007). Electronic books in general and electronic textbooks in particular, are harbingers of the promise of a new era in publishing. The traditional array of stakeholders related to books include authors, editors, publishers, printers, distributors, and readers. In the case of textbooks, curriculum designers and educational functionaries are added to this mix. The power relations among these traditional stakeholders evolved and solidified over the last centuries. Digitizing books challenges this set of power relations.

Saving the cost of paper and printing, minimizing the process of distribution, and doing away with the problem of outdated stocks was only the beginning. Digital books are also searchable, can be conveniently annotated by the reader, and can easily incorporate multimedia as well as internal and external hyperlinks to additional sources. Digitized books require no shelf-space and can be accessed online, obviating the need to carry around a physical copy. If necessary, they can also be printed on demand (Brown & Raisamo, 1997; Brusilovsky, Schwarz, & Weber, 1996; Ismail & Zainab, 2005; Libbin, 2001; Maxymuk, 2007; Wilson, Landoni, & Gibb, 2003). When placed online, digital versions of books introduce potentially new business models, and implement novel reading regime set-

tings. Digital books may even be more influential, if the cultural analyses of long tail distributions and their effect on culture (Anderson, 2006) prove to be accurate.

Electronic textbooks have not yet fully delivered on expectations. Adoption is slowed down by issues such as convenience of use, formats, the availability of portable e-book readers, costs and copyright issues (Armstrong, Edwards, & Lonsdale, 2002; Towle, Dearnley, & McKnight, 2007). Nevertheless, significant efforts are being made to offer online textbooks to the public. An interesting example is the Israeli Open University's initiative of offering free online access to fifty full text versions of their course textbooks, augmented by a full audio version of the textbook, as well as by additional learning materials (The Open University of Israel, 2007). Even if the implementation of digitization for books is piecemeal and slow, the innovation introduces a completely new division of power among the stakeholders of the book publishing ecosystem.

### 1.3. Wikis

Wiki, "the simplest online database that could possibly work" (Leuf & Cunningham, 2001, p.15) is already prominent in knowledge spaces. Ward Cunningham published the first wiki in 1995, articulating its promise as a linked collection of free and extensible web pages. Wiki is a hypertextual system for storage and transmission of information. Every page on a wiki is created and editable through the web using a web browser. The vision of wikis is an evolution from plain hypertextual systems for learning and information retrieval. Wikis express a high point in the attention to the connection between community and content. The success of wikipedia is the most prominent example of the potential of the wiki concept, as well as of the concept of the "Wisdom of Crowds" (Surowiecki, 2004). Articles on wikipedia exhibit a surprising level of accuracy, even in comparison to established encyclopedias (Giles, 2005), though the quality of these articles is a highly controversial topic in an ongoing debate (e.g. Nature Publishing Group, 2007; Seigenthaler, 2005).

### 1.4. Wikitextbooks

Wikitextbooks are textbooks which are written using wiki technology. Using a wiki to develop and to distribute a textbook marks a fundamental shift in the concept of a textbook, a shift which we are only now beginning to explore. A wikitextbook combines the attributes of the textbook, of the e-book, and of the wiki. This hybrid construct will become a success if it leverages the advantages afforded by e-books and by wikis, and improves on some of the limitations of textbooks. The concept of wikitextbooks is less mature than traditional e-books and wikis, and has even less support or proof. However, some of the early experiments in this area (Cragun, 2007; Guth, 2007; Parker & Chao, 2007; Tal-Elhasid & Meishar-Tal, 2007) show promise of reforming the field by shifting power from the traditional and powerful publishers, and empowering less powerful individuals such as students and teachers, as well as strengthening entities such as educational institutions and other organizations.

In this paper we describe one such experimental wikitextbook, and provide some data to report on the implementation and adoption processes. The wikitextbook described here was developed in response to a recognized market failure. It provided a textbook in a place where commercial market forces would not have led to such an offering. In this work we

describe the needs that led to the development of this wikipediatextbook, the process of developing it, and the results of these efforts. We show that the potential impact of a wikipediatextbook can extend well beyond the mere offering of an alternative textbook, and that it can impact educational paradigms, as well as deeply influential relationships between the various stakeholders of higher education. The potential of the wikipediatextbook to empower these stakeholders is explored.

## 2. The project

### 2.1. *The concept*

The need to develop a wikipediatextbook arose in the context of the teaching of an introductory information systems (IS) course in Israeli universities. The IS field is subject to textbooks running out of currency very rapidly. Textbooks are often very expensive, and even more difficult to maintain in languages that have smaller population sizes. One of the only two IS textbooks that existed at the time in Hebrew was an outdated e-textbook from the 90s that was authored by one of the authors of this report. The proposal was to publish the outdated e-textbook as a wiki, and to invite students and the public to update the textbook. Each student will work on improving small fragments of the textbook as part of their learning assignments. The overall result was a dynamic and up-to-date online textbook, available to IS students across all universities, in Hebrew, and free of charge. Moreover, it was assumed that the process of contributing to such a textbook will be an empowering learning experience for the students, and a contribution to the academic institutions, to the discipline and to educators in academia and beyond.

The original textbook comprised 225 sub-sections. These were converted into wiki format using a software bot written in Perl especially for the project. In addition, some PHP programming was implemented to allow users to smoothly integrate academic citations, and to create a dynamic table of contents. The project was launched in 2005, and is ongoing since then. More than 20 classes have used the wikipediatextbook so far, comprising about 1200 students in three separate universities. Multiple instructors in each university adopted the wikipediatextbook as their primary assigned text. Over this period of time, the wiki served more than 10 million web requests.

### 2.2. *Project description*

#### 2.2.1. *The participants*

The participants in this project were undergraduate and graduate students from three Israeli universities. The students belonged to seven departments, including Management, Industrial Engineering and Management, Information Systems Engineering and Management Information Systems. The language of teaching in all classes was Hebrew, which is both the native tongue of the majority of the students, and the official and legally specified language of instruction in Israeli institutions of higher learning. A significant minority of the students were native speakers of other languages, including Arabic, Russian and English. However, all students were proficient in Hebrew. A typical age range for the undergraduate students was 18–25, and the graduate (executive MBA) students who participated were about 15 years older.

### 2.2.2. The wiki assignment

The wiki assignment required students to read and augment existing sub-chapters in the wikipertextbook, as well as to create new sub-chapters. In some of the classes, the students received credit for updating the wiki, and in other classes updating the wiki was an elective assignment. In the case of the compulsory assignments, the relative amount of student activity on the wiki was taken into account when calculating the grade. In the case of each class and for each student, the exercise lasted approximately 10 weeks, and accounted for no more than 5% of final grade. All students received a 20-minute in-class introduction to using a wiki (logging in, editing, saving, viewing history), and consequently did not experience difficulties in using the wiki. The software that was chosen for the wiki was MediaWiki (<http://www.mediawiki.org>), which allows users to write in any language, including the right-to-left Hebrew. The Mediawiki platform is the same platform utilized by wikipedia, leading to a familiar “wikipedia-like” user interface: one column with useful links to special pages such as recent changes, home page etc. Above each sub-chapter are tabs leading to edit or discussion mode. The default interface was Hebrew. The content of the wiki was dynamically monitored by the project coordinators. The editing policy was to edit out spam and acts of vandalism, as well as significantly misleading information. Less significant issues were left for the participating students to correct. All work carried out within this assignment was done in Hebrew.

All http logs created during the project were saved and analyzed, including information about all activities of each of the students, based on their username or the IP address of anonymous contributors. In addition, the end-of-course examination grades of four classes were collected. A *t*-test was performed to compare the achievements of students who contributed to the wiki, with the achievements of the students who chose not to participate in the wiki activity. In one of the courses, open text feedback about the wikipertextbook experience was collected.

## 3. Results

In the period between May 2005 and November 2007, 7894 user edits were carried out on the wikipertextbook. Three hundred thirty nine sub-chapters were added by the users to the initial 225 sub-chapters, resulting in a total of 564 sub-chapters. Ninety one images were added by the users to the initial 172 images. Some of the uploaded pictures were photographed by the users themselves. The wiki activities started as a class assignment, and now continue without institutional guidance: as of November 2007, there are 1217 registered users in the system. During the first five months the system remained open to every Web user. This policy was tightened following a spam and vandalism attack, and the system now allows only registered users to make edits. However, any Web user can register.

### 3.1. Usage long tail

The distribution of user edits (range: 0–384, mean: 10.93, S.D.: 33.99, median: 4) is presented in Fig. 1. The number of edits each user made in the wikipertextbook presents a long tail distribution: 171 users edited the book once and 102 edited the book twice, while one user edited the book 229 times and another user edited it 384 times.

The distribution of the number of pages edited by users (range: 1–183, mean: 5.18, S.D.: 16.18, mode: 2) is presented in Fig. 2, and the distribution of the number of new pages

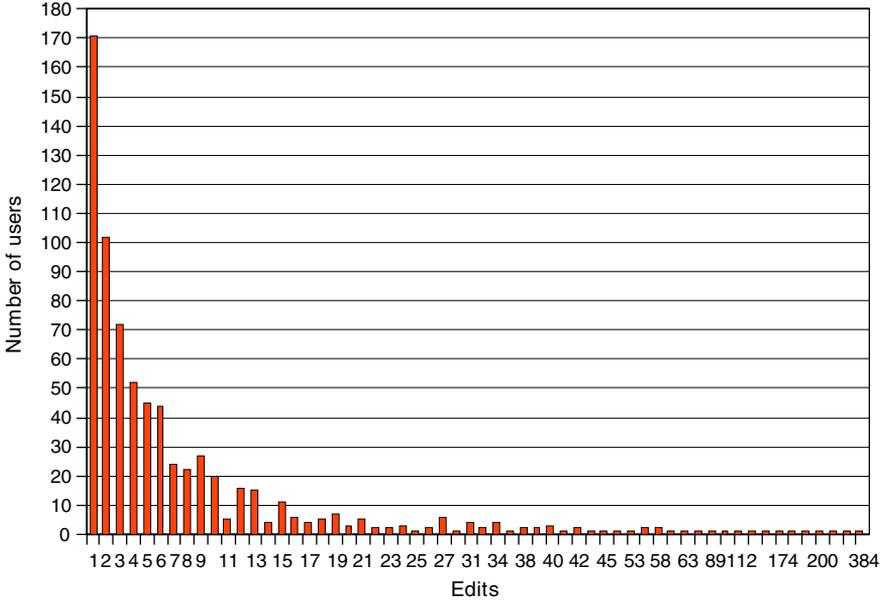


Fig. 1. Distribution of the quantity of edits made by users.

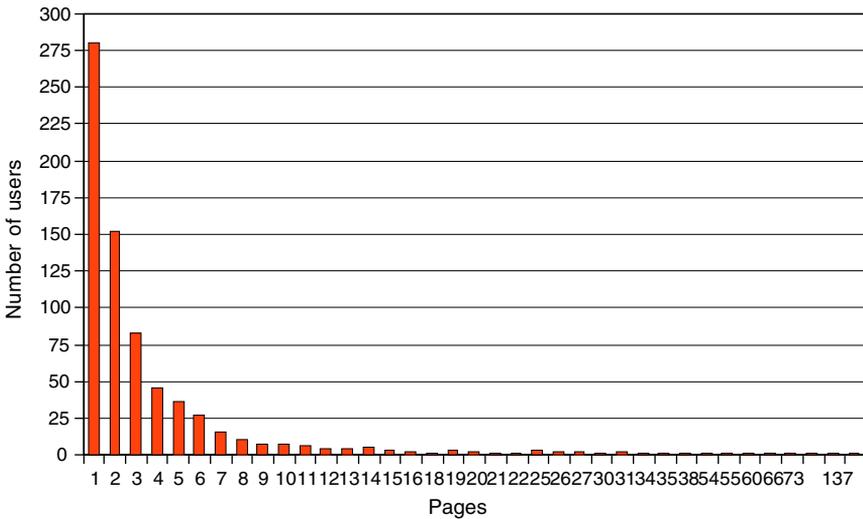


Fig. 2. Distribution of the quantity of pages edited by users.

created by users (range: 1–25, mean: 1.92, S.D.: 2.26; mode: 1) is presented in Fig. 3. In both figures, the same long tail phenomenon is clear: a small number of the users make the majority of the changes, while the rest of the users make little or no contribution. The distribution of the total number of days of activity on the system (range: 0–345, mean: 10.75, S.D.: 45.37; median: 0) per user is presented in Fig. 4, showing that 450 of the users

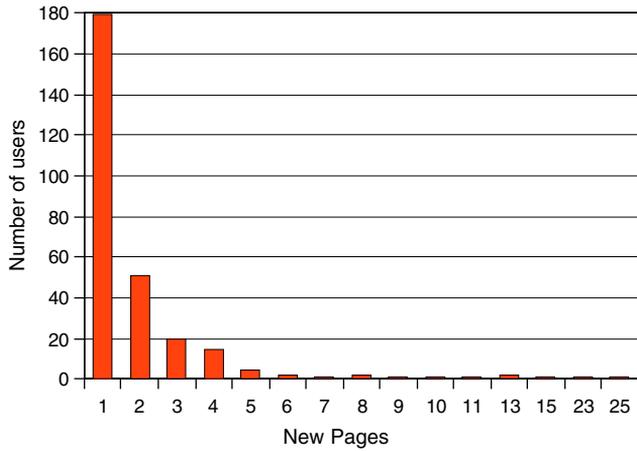


Fig. 3. Distribution of the quantity of new pages created by users.

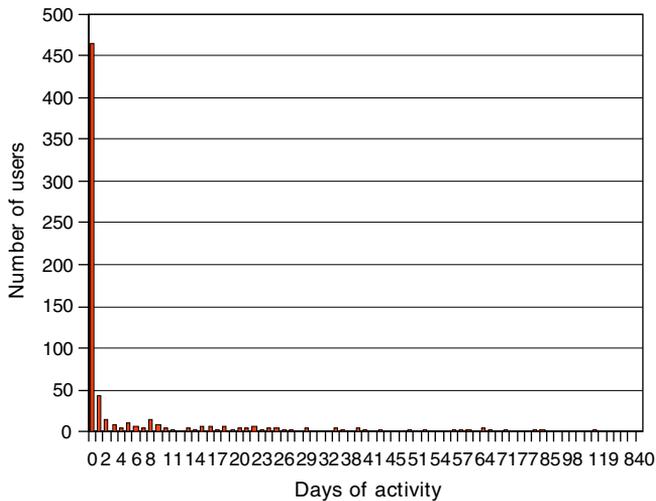


Fig. 4. Distribution of the number of days of activity on the wiki, by number of users.

made all of their contributions within a span of less than 24 h, while 18 were active for longer than a semester.

### 3.2. Wiki contributions and performance

Table 1 displays the grades of students in four of the classes, comparing the average grade of students who contributed to the wiki, with the average final exam grade of those who did not contribute. The four classes were taught by three different instructors, in different departments of the same university. Classes 1 and 2 were undergraduate engineering

Table 1

Average end-of-course examination grades for students, by class and by participation in the wikitextbook activity

Class number	Participation in wikitextbook	Average exam grade	S.D.	N
1	No	71.82	9.53	28
	Yes	70.55	13.45	33
2	No	67.72	10.63	29
	Yes	70.93	12.45	29
3*	No	56.34	12.56	23
	Yes	65.07	7.77	17
4*	No	51.97	9.83	32
	Yes	56.61	8.94	27

\* – Significant difference between participants and non-participants at  $p < 0.05$ .

classes, while classes 3 and 4 were under graduate management classes. Accordingly, the final examination grades of classes 1 and 2 were based on one examination, while the final grades of classes 3 and 4 were based on a second examination. A  $t$ -test shows that in two of the classes the difference between the groups was not statistically significant, and that in two of the classes the grades of those who participated were significantly higher than the grades of the students who did not contribute to the wiki. The difference is statistically significant when using  $t$ -test at the 95% confidence level: group 3:  $t(38) = 2.5260$ ,  $p < 0.01$ ; and group 4:  $t(57) = 1.88$ ,  $p < 0.05$ .

### 3.3. Student feedback

At the conclusion of one of the classes who participated in the project, students were asked to provide reflective feedback about their experience with the wikitextbook. For many of the students this was the first time they actively contributed to a wiki. Overall, the students reflected positively over the experience: “*I enjoyed the experience since it gave me a feeling I am ‘teaching’ other users and sharing my knowledge with them*”; “*I felt that I am contributing to a knowledgebase about information systems*”; “*The book is an accessible, friendly and informative solution*”. Users described how the assignments “forced” them to explore a topic in more depth than otherwise: “*receiving credit for correcting errors caused me to read chapters I would otherwise not have read*”; “*after reading and making slight edits and corrections to the Napster sub-chapter, I went ahead and wrote a new sub-chapter on peer-to-peer systems*”. A student who was initially skeptic about the process eventually reported that “*the responsibility of changing content, sharing it with others and publishing it made me feel good*”. Some students reported that they did not learn anything from the experience since they only wrote what they already knew, while others said that “*I never had the opportunity to ‘contribute’ knowledge that I had, knowing that others will depend on this knowledge as a reliable source, like a book or an article.*” And “*despite the fact that I was already knowledgeable about the entries I wrote, the feeling that others will rely on the knowledge I provide made me check and recheck the accuracy of what I wrote. This is a win–win: the writer who deepens his knowledge, the readers who receive detailed and reliable information, and the website*”. Some students reported that the exercise exposed them to new knowledge “*I chose a topic with which I was only superficially acquainted, focused on it for a few days, and studied it in depth.*” Others felt that no new

learning took place “*Actually, I did not learn from updating the book, but rather only entered material I already knew beforehand*”. Of course, reporting on students mastery of new topics cannot be left to such self-assessment alone. All students were tested using objective, external instruments and the overall picture is of learning across the board. Regardless, students felt that they, as well as others, benefited from the experience both directly and indirectly: “*The significant contribution of the exercise is not necessarily in adding 20 new entries to the book, but rather in the actual existence of such a book and the idea that stands behind it which was foreign to me and to others in the department. Through the exercise I was acquainted for the first time with the important concept of knowledge sharing (and not only file-sharing...) and of the wiki as a knowledge management tool*”. And “*an exercise like this is less of a benefit to the student who writes or edits a wiki entry, but the great contribution is in the expansion of a knowledge repository that others can learn from.*” (Italicized quotes are free translations from the original Hebrew quotes).

## 4. Discussion

### 4.1. Discussion of results

The results described in Figs. 1–4 are not surprising. Such long tail distributions are typical in other wikis (Ravid, 2007; Wilkinson & Huberman, 2007), as well as in other online activities (Kalman, Ravid, Raban, & Rafaeli, 2006). What is important to note in relation to this distribution is that it is a reminder that there is no “typical” or “average” student, and that there are orders of magnitude size differences between different students. For example, in Fig. 1 it is evident that a relatively small number of users made a large number of edits, while the majority of the students made few such edits. Moreover, a close inspection of the user names of the more active users in Figs. 1–3 reveals that the users who participated the most in one activity (e.g. editing existing pages), were not the same users who participated the most in other activities (e.g. writing a new sub-chapter). A possible explanation for that is that the skills and knowledge required to fix spelling and grammar mistakes on many pages (Fig. 1) are different than the skills and knowledge required for initiating a new sub-chapter (Fig. 3).

What can we learn from the relationship between the exam grades and the wiki activity in two of the classes? These results should be interpreted with caution, especially given the fact that the seemingly positive effect of the wiki activity on final exam grades appeared in only two of the classrooms. However, one possible interpretation is that under some conditions, the involvement of the students in the wikipediatextbook activity improved their acquaintance with the course materials. These conditions include: (1) different teacher; (2) different exam; (3) different student major. Alternatively, it is possible that the stronger students were more inclined to participate in the activity, in relation to students whose confidence in the course materials was weaker. Both interpretations point to the potential of the wikipediatextbook activity to empower students. In the case of better students being the causal factor for the higher grades, the wiki was enriched and contained new, improved and up-to-date material brought forth by the stronger students, for the use of all students. Alternatively, the wikipediatextbook activity might have led to better academic performance of the students, which was reflected in the final exam grades.

The open text responses provided by students who participated in wikipediatextbook-supported classes suggest an overall positive reaction to the exercise and innovation. We

encounter many examples of students describing their experience as not only enjoyable and educational, but also specifically as an empowering experience.

#### 4.2. *Wikitextbooks and empowerment*

Can wikitextbooks be a tool for empowerment? We suggest that our experience provides a glimpse into the potential of wikitextbooks to become vehicles for the empowerment of students, teachers and classes, and for the strengthening of educational institutions, disciplines, minorities, and society in general. The collaborative technology as platform, and the alteration of roles and power relations brought about by the new method, enable a new kind of student–teacher–curriculum relationship. Whether this novelty is also an improvement remains an open question.

Empowerment could mean different things for different people (e.g. Zimmerman, 1995). Duhon-Haynes (1996) presented a coherent description of the role of empowerment in education. She cited Ashcroft (1987) who explicated the empowering process as “bringing into a state of belief one’s ability to act effectively”, and the “nurturing belief in capability and competence” (Ashcroft, in Duhon-Haynes, 1996 p.3). In the context of education, Duhon-Haynes focused on Nel’s (1992) empowerment of teacher–student relationships, in which teachers incorporate the language of students into the school program and promote students to use language to generate their own knowledge. Another aspect, based on Stone’s (1995) work, is that respect, validation and focus on success are empowering for both teachers and students, and on the fact that these three components lay the foundation for further empowerment facilitated through ownership, choice, autonomy, decision making, responsibility, independence, risk taking, collaborating and self-evaluation. She continued by reminding us of Stone’s conclusion that empowered students free the teacher to join students in facilitating growth rather than just monitoring the students’ learning, and concludes by pointing out Ashcroft’s corollaries to an empowering philosophy: (1) of learning as an internal and subjective action, a process of inquiry and discovery; (2) knowledge as something that is not a fixed and finite truth that can be given, but rather as something that needs to be reached internally by each learner; (3) of development as personal growth, a transformation or change of something that the learner already has; and (4) the conception of the classroom as a community focused on mutual assistance between its members. Duhon-Haynes concluded by focusing on the perception of student empowerment as something more than a strategy for academic success, but rather a philosophy of education that goes beyond the walls of the classroom and influences the productiveness of the students as members of society.

#### 4.3. *Wikitextbooks as an empowering agent*

The wiki is a participatory medium (Rheingold, 2007). Students are empowered by their participation in the educational process. The open text feedback of students attests to this participatory element, which was experienced both by students who felt that the wiki exercise benefited them directly, as well as by students who reported no such benefit. Unlike the traditional approach to students as relatively passive participants in the educational process, building a wikitextbook places the student in a role traditionally assigned to a distant and disengaged expert. Students are thus empowered by incorporating their own lan-

guage into the wikipediatextbook, making decisions about what to include and what not to include, working independently, collaborating and self-evaluating, and in general, taking partial ownership in the textbook creation process (Bold, 2006). Moreover, the ownership goes beyond the specific wiki exercise, and becomes ownership of the whole learning process, through the constructivist approach (Parker & Chao, 2007) which empowers students by acknowledging their role as active participants in the process.

Teachers too can be empowered by the use of the wikipediatextbook exercise. Traditionally, the teacher's role in regards to the textbook ends before the course even starts, when the decision on the course text is taken. A teacher who leads the construction of a wikipediatextbook with his or her students is empowered through increased involvement, through increased choice, through a closer collaboration with the students as individuals and with the classroom as a group, as well as through the empowerment that results from delegating responsibilities to the students. This delegation can further increase the level of empowerment since such delegation increases the motivation of the delegated party (Conger & Kanungo, 1988). In addition to the empowerment of individual students and teachers, the collaboration over a wikipediatextbook can further empower the participants by the formation of a learning community. In this learning community, each participant is able to contribute their individual strengths to the joint effort, thus creating synergy and leveraging diversity. For example, a student who has less expertise in the subject matter, but who has above average writing skills can contribute by reading and proofing the contributions of more knowledgeable students. In addition, the learning community is no longer confined to the walls of the single classroom. For example, in the project described in this paper, the learning community linked students and teachers separated by geography and by time.

The empowerment through the use of a wikipediatextbook can extend well beyond the specific learning goals of the students. For example, the fact that the wikipediatextbook is free of charge, empowers students with limited financial resources who might not be able to meet the rising cost of academic textbooks. Students whose native tongue is not ubiquitous enough to economically justify the publication of a textbook in that language are no longer disadvantaged by the need to study from a textbook written in one of the more predominant languages. The example provided in this report of a wikipediatextbook in Hebrew illustrates this point. Anecdotal evidence from academic libraries and bookstores in Israel is that assigned textbooks not written in Hebrew are used much less frequently than assigned textbooks in Hebrew. Similarly, a wikipediatextbook can increase the power of an academic discipline which is relatively small and might not justify the publishing of a diverse set of textbooks. A wikipediatextbook can allow a group of teachers to develop a textbook that represents their common viewpoint on the discipline, even if it is a minority viewpoint. Female students who might be less likely to contribute to a spoken classroom discussion, are likely to feel more comfortable to contribute to an asynchronous written discussion that takes place in the wiki, thus being empowered through increased involvement in the learning process. In the IS wikipediatextbook project, we have anecdotal evidence that shows a disproportional representation of female students in the group of highly active contributors to the wiki.

The wikipediatextbook that is produced through the collaboration of students and teachers can, and probably should, have effects at the level of the community. Wiki processes are community-based and contingent on community nature (Rafaeli, Hayat, & Ariel, 2005). They have community-level effects on cohesion, sense of belonging, solidarity, peer-to-peer

learning, and group sense of efficacy. Wikis may also contribute to society if and when they are made freely available online. Mass collaboration requires more openness and free access than is possible in the closed-system model of printed material. It also carries a major promise to re-align business models. An open-source resource can then be used by other students at various educational stages, including K-12, vocational and professional education. It can also be used by other individuals for various personal and professional purposes. For example, although all the classes using the online material developed in this course were local to Israel and conducted in Hebrew, we had strong evidence for wider use and effects. The http log files indicate that in the IS wikibook described here, about 30% of the page requests were from users outside of Israel, and about a quarter of the requests were via links provided by a search engine in response to a search query. Both of these categories of users were likely not the students who participated in the described courses.

## **5. Limitations**

The case study reported here is an early, exploratory investigation. Our evidence and experience suggest that a Wikibook offers an exciting opportunity to empower students, teachers and others. Nevertheless, before taking the evidence presented here as conclusive, attention needs to be given to several methodological and appropriate design, operation, and monitoring questions. Simply providing access to information does not automatically lead to empowerment (Adams, Blandford, & Lunt, 2005). Digital divide research shows that providing access to the technology is only a first step in empowering the users, and that issues such as perceptions, attitudes towards technology and social influence can augment or diminish the usefulness of the technology (Barzilai-Nahon, 2006). Empowerment is also a relative concept, and the empowerment of one stakeholder could potentially weaken another stakeholder. For example, in this Israeli study, the native tongue of the majority of the students was Hebrew. For these students a textbook in their native tongue was more accessible than a typical textbook in English. Nevertheless, a minority of the students were native speakers of Arabic, Russian and English, as well as possibly other languages. For these students, the move to a Hebrew textbook might not have had the same positive effect. This is especially pertinent in the case of a fundamental change of the status-quo such as allowing students to partake in the creation and the editing of a textbook. Another consequence of the relative nature of empowerment is the danger of differential empowerment, a process by which stronger members are disproportionately empowered, thus increasing the gap rather than narrowing it. Lastly, this preliminary and exploratory field study was performed without controlling for independent variables. The subject matter chosen for this exploratory wikibook was in one of the most rapidly evolving fields. Information systems, as an intellectual field and subject matter of higher education, is traditionally both most receptive to textbook changes, and most in-need of ongoing and massive rewriting of texts. In this sense, the case reported here stops short of being a conservative test of a theory. It is, at most, an illustrative proof-of-concept and call for further research.

For all these reasons, caution is advised. More controlled studies should precede sweeping generalizations. The exploratory idea proposed here should be further explored in other domains, using a variety of corollary teaching methods, and examined within the context of diverse class sizes, student types, and disciplines.

## 6. Further research

This case study suggests the potential positive impact wikibooks can have in the classroom. Careful assessment of this potential requires further research attention. One recommended framework for a research agenda for this purpose, is suggested by the Learner-Centered Principles Work Group of the American psychological association board of educational affairs (BEA) (APA Education Directorate., 1997). The agenda lays out 14 proposed principles in four categories: cognitive and metacognitive factors, motivational and affective factors, developmental and social factors, and individual differences factors. Following are research questions that address each of the 14 principles.

### 6.1. Cognitive and metacognitive factors

The student feedback, as well as the increase in final exam grades in two of the classes, suggest that the wikibook exercise could assist student learning through the enhancement of cognitive and metacognitive factors. Further work should explore (1) whether the work on a wikibook makes the process of constructing meaning from information and from experience more explicit and thus intentional; (2) does the creation and editing of wiki entries help create meaningful and coherent representations of knowledge; (3) does the work on individual entries, as well as on linking wiki pages, help the student link new information with existing knowledge in meaningful ways; (4) does the experience of working on a wiki increase the repertoire of learning strategies; (5) will collaboration on wikibooks increase the application of higher order creative and critical thinking; and, (6) does the wiki environment influence learning at varying levels of prior knowledge, cognitive abilities, and learning and thinking strategies.

### 6.2. Motivational and affective factors

Participant feedback suggests that the wikibook exercise impacted student motivation as well as affective factors. Future research should explore: (7) whether a wikibook exercise impacts student emotions and motivations; (8) whether the wikibook exercise increases internal motivation by being: interesting to the learners, personally relevant and meaningful, comparable to real-world situations, and by meeting learner needs for choice and control; and, (9) whether the wikibook exercises lead students to increased effort, commitment and persistence over time.

### 6.3. Developmental and social factors

A collaborative exercise like working on a wiki is thought to accommodate the needs of a heterogeneous student body (Dillenbourg, Baker, Blaye, & O'Malley, 1996). The research questions suggested here explore: (10) how student heterogeneity along intellectual, social and emotional domains impacts learning through the collaboration over a wikibook; and, (11) how interaction with other students through wikibook use may impact thought flexibility, perspective taking and reflective thinking.

#### 6.4. Individual differences

Like every teaching method, the wikibook exercise is expected to impact different students differentially (Jonassen & Grabowski, 1993). Since the exercise is relatively flexible it has the potential to accommodate individual differences more effectively than traditional methods such as lectures, thus empowering students who are disadvantaged by the more traditional educational approaches. Future work in this field could explore: (12) how a wikibook exercise can teach students to examine and expand their learning preferences; (13) how a wikibook exercise accommodates differences in learners' linguistic, cultural, and social backgrounds; and, if students are truly empowered by the exercise, (14) what standards and measures should be used to measure student performance and to evaluate the empowerment of students through a wikibook exercise (Fetterman, Kaftarian, & Wandersman, 1996).

### 7. Conclusions

Mass-collaborative, user-generated online systems are in their infancy. One aspect of the novelty, treated only in passing here, is the new business model for textbooks that is introduced here. The open, free availability of materials that are expensive makes for a new economy of information. This impacts the learning environment in ways that were not studied here, but are both novel and important to mention. Another aspect of wikis as content-creation mechanisms is the quality and validity of the information generated by the wiki process and stored in wikis (Giles, 2005; Harper, Raban, Rafaeli, & Konstan, 2008). Going beyond business models and quality, this study focuses on the empowerment of students suggested by mobilizing them into positions of content creators for each other, and for future students.

The jury is still out on the viability or validity of the promises made by these new technologies and their proponents. It is too early to judge the (controversial) sustainability of such systems. We still do not know whether such systems can be autonomous and self-generating or do they require a starter, a critical mass injected "from above", as was the case with the initial content here? Many other questions remain. However, the broad success of wikipedia, and the spreading ideology of "Wisdom of Crowds" is difficult to ignore. The status of wikipedia has been jokingly described as something which "can't possibly work in theory, but does work in practice" (Wikipedia contributors., 2007, December 31). Our attempt here was twofold: to import the collaborative notions of wiki from the context of encyclopedias to that of textbooks, and to suggest a theoretical context that would explain one aspect of its success: empowering students and curricular subject matter through the realignment of power structures.

We begin with the ideas that online systems, as mass collaboration platforms, can be taken beyond storage, policing and delivery, and used in the formation and maintenance of text materials in higher education. Students – traditionally limited to the passive role of recipients – might become active partners in the creation and continuance of the corpora of information that they learn from.

In the context of learning institutions and processes, one of the most powerful theoretical drawbacks of online, user-generated content systems is, in fact, weakened. The problems of motivation to contribute and potential free-riding (Rafaeli & Ariel, 2008) is eliminated here. It is simply not that much of a threat in the context of monitored and

tutored learning and within systems that contain graded-assignments. These ideas are, at the very least, intriguing.

We continue to propose that such enlistment of students in active roles of content-creation is in line with other constructivist uses of computerized and networked innovations. Constructivism implies empowerment, and enables it. The case study presented here suggests data that support these ideas. This type of use of the so called “disruptive technology” is disruptive, first and foremost, to the traditional power structure. Both student and curriculum stand to be improved and empowered by such disruption.

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