



e-mentor

Number 3 (80) 2019

ISSN 1731-6758



ICT in education
Lifelong learning
Business and technologies
New trends in management
Teaching methods and programs

Table of Contents

3 From the Editor

Teaching methods and programs

4 Challenges Related to Identifying Sources and Document Collection for Big Data Analyses

Grzegorz Gmiterek

10 The Role of Motivation in the Self-education of Future Teachers

Irina Dubrovina, Kateryna Horash, Tetiana Radzivil, Tatiana Oliynyk

ICT in education

18 The Identity of Young Adults and their E-learning Performance

Wioletta Kwiatkowska

24 Using Instructional Media to Improve Student Learning Outcomes in an Online Toxicology Course – a Case Study

Egbe Egiebor, Oluwakayode Adebowale, Tian-Lih (Ted) Teng

34 Playing with Benford's Law

Tomasz Kopczewski, Iana Okhrimenko

New trends in management

45 Modern Perceptions of Career Success

Adam Metelski

51 Competition Mechanisms in the Sharing Economy

Małgorzata Godlewska

58 Barriers to Knowledge Sharing for Prosumers and Global Team Employees

Celina Sotek-Borowska, Monika Eisenbardt

Education worldwide

67 Rethinking Learning Engagement with Gen Z Students

Vickie S. Cook

Lifelong learning

71 Agile for Instructional Designers – review of the book by Megan Torrance

Maria Zajęc

73 Making Art with 3D Laser Cutting. Audio-enriched Tactile Poetry

Michael Kolitsky

e-mentor

printed version
of the open access academic journal
e-mentor.edu.pl

Publishers:

SGH Warsaw School of Economics
&
Foundation for the Promotion
and Accreditation
of Economic Education

ISSN 1731-6758

Editorial office:

SGH Warsaw School of Economics
Centre for Open Education
al. Niepodległości 162
02-554 Warsaw, Poland
tel. 22 564 97 23
fax. 22 646 61 42
redakcja@e-mentor.edu.pl

Editorial Board

prof. Kazimierz Kloc
prof. Maria Aluchna
prof. Piotr Bołtuć
prof. Ilona Buchem
prof. Wojciech Dyduch
prof. Luciano Floridi
prof. Andrzej J. Gapiński
prof. Jan Goliński
dr Jan Kruszewski
dr Stanisław Macioł
dr Frank McCluskey
prof. Krzysztof Piech
prof. Marek Rocki
prof. Maria Romanowska
prof. Waldemar Rogowski
prof. Piotr Wachowiak
dr inż. Anna Zbierchowska

Editorial team:

Editors: Marcin Dąbrowski, Maria Zajęc

Editorial Assistant: Karolina Pawlaczyk
Content Editor: Katarzyna Majewska, Joanna Zajęc

Typesetting: Elżbieta Wojnarowska
Cover design: Piotr Cuch

Journal website:
[Piotr Gęca, Krzysztof Kalamus, Łukasz Tulik](http://Piotr_Gęca, Krzysztof_Kalamus, Lukasz_Tulik)

*Journal with (20) points awarded by Poland's
Ministry of Science and Higher Education.
Scientific articles are peer reviewed.*

Print: 1000



Dear E-mentor readers,

After the success of our first attempts to reach the international audience by the E-mentor academic journal, we continue our project, based on publishing some e-mentor volumes entirely in English. The current issue covers a range of topics reflecting how technology influences both the teaching and learning processes at the university and knowledge management in the corporate environment. Quite a lot of attention has been devoted to peoples' attitudes, behaviors, and expectations stimulated by the changes in contemporary societies. On the one side, the reflections concern broad issues such as knowledge exchange in the sharing economy or the perception of career success. On the other, they refer to more specific topics like the relationship between students' online learning performance and their individual identity or dependence on the learning results on the features of Z Generation as a whole.



Another aspect is being considered by the group of authors who present the results of research on how different types of media used for delivering learning content influence the learning outcomes. The two others describe the results of applying computer simulations to teaching real-life examples during the microeconomics course.

And last but not least, it is worth to mention two articles not directly linked to teaching – one opens this volume, and the other one closes it. The first refers to the richness of information and analyzes the obstacles in deriving the knowledge from the big data sets collected in the libraries and online catalogs. The second mentioned article tackles the accessibility issue illustrating it by a bit unusual example of creating the art which can be touched and heard, which makes it accessible to visually impaired or blind visitors of exhibitions centers. That, quite a new trend of making art accessible, appears more and more often in contemporary publications, including e-mentor journal as well.

The process of publishing the international versions of E-mentor entirely in English will be continued in the year 2020 as well. We do encourage the researchers both from academia and from business to publish with us. E-mentor is an open-access journal available for free online and in printed form. There is also no charge for publishing. All scientific papers are peer-reviewed (we apply the double-blind review procedure), and the journal is indexed in several international databases, including Web of Science ESCI base.

A brief guide for Authors can be found on last but one page of the journal. More detailed instructions and the submission form are available online at http://www.e-mentor.edu.pl/eng/page/8/Info_for_Authors. If you have any questions concerning the publication in e-mentor, please contact the editorial team at redakcja@e-mentor.edu.pl.

Maria Zajac
Editor



„Kontynuacja działań na rzecz zwiększenia międzynarodowego zasięgu czasopisma E-mentor w wersji drukowanej i online (o otwartym dostępie)” – zadanie finansowane w ramach umowy nr 693/P-DUN/2019 ze środków Ministra Nauki i Szkolnictwa Wyższego przeznaczonych na działalność upowszechniającą naukę.



“Continuing the actions aimed at increasing international outreach of E-mentor scientific journal in print and online (open access)” – a task financed under the agreement No. 693/P-DUN/2019 from the funds of the Minister of Science and Higher Education in Poland designated for the dissemination of research and science achievements.



Challenges Related to Identifying Sources and Document Collection for Big Data Analyses

Grzegorz Gmiterek*

For some time now we have been witnessing a gradual but dynamic increase in the volume of information, the existence of which has had an increasing effect on our lives. The amount of digital data generated daily is estimated at 3 trillion bytes, and continues to grow by the day (Global AI Bootcamp, 2018). This is a result of data being generated by various digital platforms, as well as sensors, the internet and the billions of cell phones used every day (Henke et al., 2016). The mass storage capacity of these devices is increasing, and the cost of storing data is declining rapidly. The information overflow which occurred during the first decade of the 21st century was accompanied by phenomena such as the rapid influx of information and knowledge, but also the intensification of information chaos (Babik, 2010, p. 22). The creation of mass information resources is a global phenomenon affecting various areas of life, science, culture, the economy, etc. It is thus no wonder that Płoszajski (2013, p. 6) claims that we are witnessing the advent of a revolution which brings with it unlimited data processing as a result of the exponential growth in computing power, as well as broader and more affordable access to the data.

For the purpose of this article, the following definition of big data found in the relevant literature is used: *the term is used to refer to data sets which are large in volume and diverse, accumulate in real time, are changing, complex and require the use of innovative technologies, tools and IT methods for the purpose of extracting new and useful knowledge (Tabakow, Korczak and Franczyk, 2014, p. 141).*

Purpose of the article and methods

The purpose of this article is to analyze selected issues and challenges related to identifying and collecting large volumes of digital information (big data) from the perspective of information science and within the context of applying the tools and resources offered by libraries (primarily research libraries). The research process was qualitative in nature, with a critical analysis of the relevant literature as well as of documents found in technical and specialist press

and on websites. An important source of knowledge on publications concerned with identifying and collecting large volumes of data was the Library, Information Science & Technology Abstracts database, which contains information on sources from the areas of book science, information science, bibliometry etc. A query was also conducted in the abstract and full-text databases available via the Chamo discovery system offered by the Warsaw University Library, which integrates the resources from several dozen scientific and thematic sources.

The purpose of the article was also to characterize certain functional tools (in particular discovery systems) and to identify major issues related to sources and searches in the processing, collecting and organizing of large volumes of data, as well as accessibility and classification from the perspective of document typology. An important source of knowledge on the topic was the experience acquired by the author over the course of the research project *Exploring sources of data on the topic of R+D+I activity*, financed via a grant awarded by the National Center for Research and Development and conducted at the Department of Media Information Technologies of the Faculty of Journalism, Information and Book Studies, University of Warsaw. The project was carried out between July 2017 and December 2018 under the supervision of Professor Włodzimierz Gogolek.

Due to article size restrictions, only selected issues have been analyzed in this paper. Not all major issues have been taken into account that a discerning reader could consider meriting analysis (e.g. the typology of sources and search tool classification criteria, information search strategies, the applications and functionalities of tools facilitating automated digital resource collection, using software which adds new functionalities to search engines and browsers). Hence a comprehensive analysis of the issues related to big data source identification, although it would be of much methodological utility, is beyond the scope of this article. However, the author hopes that this topic will be analyzed more extensively in the future.

* University of Warsaw, Poland

Information science and libraries in the world of big data processing

Big data processing has been at the center of much debate across research publications from various fields. The Web of Science (an abstract and bibliometric database developed by Thomson Reuters) database shows an increase in the number of publications submitted on this topic starting from 2012. These are publications from the fields of computer science, engineering, telecommunications, business, the social sciences, mathematics, medicine, education, environmental protection and information science. In the case of the latter, the major issues appear to be identifying sources, as well as searching, collecting, storing and organizing the large volumes of data, which requires the use of unconventional methods and tools in order to access them (including data located in what is referred to as the deep web). Of utility in this respect is an understanding of effective search methods and strategies, query languages and effective use of the bibliographic, abstract and full-text databases offered by institutions such as libraries. This applies particularly in situations where the large volume of data to be analyzed consists primarily of scientific sources.

Issues related to big data analysis have been discussed in book and information science literature, including articles on the functioning of libraries, methods of organizing resources and information/library processes. Information science is a discipline concerned with the theoretical and practical aspects of information-related activities, their tools and methods, including, in particular, information systems, informative sources, information sources, methods and tools used in information processes and the information-related behaviors of users of information systems, sources and services (Sosińska-Kalata and Pindłowa, 2017, p. 725).

It should be noted that Nicholson coined the term *bibliomining* as early as in 2003, referring to the use of data exploration methods by libraries (Nicholson, 2003, p. 146). However, it was not until recently that a marked increase in publications on issues such as big data processing has been observed within the context of information and database management. Even a cursory analysis of the most relevant search results in the Library, Information Science & Technol-

ogy Abstracts database demonstrates that there exist numerous publications on big data related to such subjects as social media, IT, AI, digital publications, data exploration and the related software, ontology, metadata and digital libraries.¹ A large proportion of these are publications presenting the idea of big data, but also indicating the challenges and possibilities related to the phenomenon. The issue is also being discussed with increasing frequency on expert portals and blogs (Wójcik, 2016, p. 63), while librarians and information scientists discuss the topic in social media.² That there is interest in the topic is evident by the increasing popularity of conferences organized in Poland on issues that relate to varying degrees with the processing of large volumes of data.³

Information scientists also describe the issue of developing a methodology to make it possible to effectively identify trends (Świgoń, 2018; Ahmed and Ameen, 2017), as well as the sources of documents and publications for big data processing (Ball, 2013; Cuzocrea, Simitsis and Song, 2017; Hoy, 2014; Reinhalter and Wittmann, 2014; Tuppen, Rose and Drosopoulou, 2016). In this case, Świgoń (2018, p. 128) defines trends as *primarily technological changes, but also other changes, e.g. social, cultural, environmental, economic, and political, which influence the human infosphere*. The infosphere is also referred to by information scientists as information space, information environment or information networks (Ibid.).

It appears that the issue of identifying trends is to a large extent related to the application of tools, abilities and methods used every day by library employees (especially employees of research and university libraries). The issue is also related to library tools which integrate the ability to search diverse digital resources, which may be part of licensed abstract and full-text bibliographic databases, abstract and bibliometric databases, as well as digital libraries and repositories. The tools offered by libraries constitute one of the fundamental methods of verifying content, which comprises frequently updated, selected literature on a given research problem. It is important to remember that this literature is not only limited to scholarly analyses (expert knowledge on a subject). Libraries, especially research and specialized libraries, offer a range of tools which enable access to various types of data, including what is referred to as gray literature.

¹ Based on the results of a search query conducted in the Library, Information Science & Technology Abstracts database on 12.21.2018. The purpose of the search was to find articles related to the term "big data". Information was found on 1262 documents created between 2010 and 2018.

² An example of this is Facebook, where a number of posts can be found by librarians and information scientists from around the globe.

³ Recent examples of such conferences include: *Big Data w humanistyce i naukach społecznych (Big data in the humanities and social sciences)*, 21–22 November 2018, Institute of Library and Information Science of the University of Wrocław; XII edition of the *Automatyzacja Bibliotek (Library Automation)* series: *Biblioteki w cyberprzestrzeni: Inspiracje Światowego Kongresu IFLA Wrocław 2017 (Libraries in Cyberspace: Inspirations of the 2017 IFLA World Congress in Wrocław)*, 13–14 November 2018, Warsaw; *Małopolskie Forum Bibliotek. Biblioteka 2.028. Między nadmiarem a niedostatkiem (Lesser Poland Library Forum. Library 2.028. Between excess and deficiency)*, 24–26 October, Krakow; *VIII Krajowa Konferencja Naukowa INFOBAZY 2017 – Bazy Danych dla Nauki – dane, wiedza, e-usługi (2017 INFOBASES VIII National Scientific Conference – Databases for Science – data, knowledge, e-services)*, 11–13 September 2017, Gdansk).

Nevertheless, the knowledge on information science possessed by librarians and information specialists may also be of utility, including the knowledge of internet search engine trends, methods of determining search and data collection strategies and sources of various types and applications. The claim expressed in an Onet.pl interview by Wiesław Cetera, one of the researchers responsible for the project *Exploring sources of data on B+R+I activity*, according to which “data processing is at the center of attention during design work and is a pivotal part of the system used in the project, but it all begins with people – information scientists who can steer exploration in the right direction,” thus appears valid. “They determine where we can expect to find useful data. It is necessary to reach them” (Żemła, 2018). Naturally, depending on the research problems and areas in which a user would like to explore sources, a different search and identification strategy will be implemented and other tools will be used. This may constitute a heuristic method of source identification and document searching.

Discovery systems and identifying document sources for big data analyses

From the perspective of identifying research articles or documents, collecting them for further big data analyses, as well as using accurate and up-to-date data for determining long-term development trends, it appears important to use the functionalities offered by tools referred to as discovery systems. These enable quick discovery and convenient retrieval of sources available in a given library (or library group). Discovery systems enable integrated searches in multiple sources at one time, e.g. full-text databases, bibliographic databases, bibliographic and abstract databases, digital libraries and archives, library catalogs, as well as blogs, websites and themed resource guides – LibGuides.⁴ Example institutions which make extensive use of the above include the Villanova University Library in the USA⁵ and the Oxford University library.⁶

As mentioned earlier, discovery systems are currently also used to develop tools which integrate information on sources from several institutions, both traditional and digital. The Lublin Virtual Library is one such case, as it enables users to search library catalogs of databases, commercial full-text bibliographic and abstract databases, as well as open access resources. The project was developed based on the Primo system

created by ExLibris.⁷ It is worth noting that discovery systems are analyzed in the relevant literature both within the context of discovery interfaces and discovery services. The solution in question constitutes software which is installed in addition to the document information access tools offered by a given library and utilizes cloud computing (Skórka, 2017, p. 136). Modern discovery systems include such open source solutions as VuFind (used by the aforementioned Villanova University library) and commercial solutions like Primo ExLibris and Chamo Discovery.⁸

A distinctive feature of the above systems is that they offer users advanced search options and faceted management of relevant search results. Facets in this case refer to the attributes of the searched documents. Using facets can help narrow down search results within a single category, organized according to a criterion available in the faceted navigation function, such as author, collection, language, type of document, date etc. As emphasized by Laura Morse from the Open Discovery Initiative and Harvard University, *discovery systems are of extreme significance to the research ecosystem* (NISO, 2014). They enable users to find the most up-to-date sources of knowledge created by researchers from around the world. What is more, such tools constitute a fundamental method of verifying content, which comprises frequently updated, selected literature on a given research problem and the accompanying metadata.

It is also worth noting that individual bibliographic, bibliographic-abstract and full-text databases also offer the aforementioned faceted navigation function. In addition, some of these databases (e.g. Science Direct) offer the option to bulk download entire texts or export search results as publication metadata into a calculation sheet or bibliography manager tool (e.g. IEEE Xplore Digital Library enables exporting search results containing the detailed metadata of publications and their abstracts as CSV files).

Typology of identified documents

Within the context of identifying large volumes of data it is worth giving at least a cursory review of the issue of the typology or organization of the documents to be processed. A suitable typology may render it easier to organize the collected content and the subsequent data analysis and result interpretation. Articles to be processed come from various sources,

⁴ More information on LibGuides can be found in Derfert-Wolf, L. (2011). *Specjalista informacji 2.0? Bibliotekarz dziedzinowy 2.0? Nowa forma przewodników po zasobach – LibGuides. Biuletyn EBIB, 119(1)*. Retrieved from <http://tiny.cc/4grhcz>

⁵ Villanova University. (n.d.) *Falvey. Memorial Library*. Retrieved 01.18.2019 from <https://library.villanova.edu/>

⁶ Bodleian Libraries. University of Oxford. *Search Oxford's Libraries Online*. (n.d.) Retrieved 9.08.2019 from <https://www.bodleian.ox.ac.uk/>

⁷ Lubelska Biblioteka Wirtualna. (n.d.) Retrieved 9.08.2019 from <http://projektlbw.lublin.eu/>

⁸ More information on discovery systems, their features and functionalities can be found in the doctoral dissertation of Dominika Paleczna. The dissertation is available in the electronic repository of Warsaw University. Paleczna, D. (2016). *Aspects of Designing and Evaluation of Library Information Systems at the beginning of the 21st century*. Retrieved from <https://depotuw.ceon.pl/handle/item/1531>

Challenges Related to Identifying Sources and Document...

e.g. blogs, microblogs, forums, information portals, RSS channels, data wholesalers (see Busłowska and Wiktorzak, 2014, pp. 2491–2493; Drosio and Stanek, 2017, p. 107; Maślanowski, 2015, p. 168; Rodak, 2017; TQMsoft, 2018). The data typically processed today come from various meters, sensors, logs, GPS devices, as well in the form of sequences of clicks on websites (Burnet-Wyrwa, 2017, p. 47). These may to a large extent constitute open-access data (Otwarte Dane, n.d.).

Resources which are to be processed may be external or internal, historical or current. The diversity of documents in big data analyses is thus a key issue, particularly in the case of processing unstructured data sets. To be more precise, it is important to note that currently more than 90% of information is recorded in an unstructured form (Kim, Trimi and Chung, 2014, p. 78).

The document typology used by a researcher can be based on content (e.g. industry-related, research, education, official, social), form of presentation, file format, method of access (including the degree of openness and confidentiality, availability in the surface and deep web), relevance, completeness, multimedia use and being up-to-date with regard to the information contained. In the case of identifying resources for big data processing, the classical typology can also be applied, which refers to the traditional division of sources into primary, secondary and derivative. This typology takes into account the origins of sources, the way they were created and the degree to which they have been processed. A distinctive feature of primary sources is that their content remains in the original form envisioned by the author. Secondary sources are created based on primary or derivative sources and reflect their features in terms of content (Głowacka, Jarocki, Kowalska, Kurkowska and Pamuła-Cieślak, 2016, p. 190). Derivative sources contain information on primary and secondary sources. Their distinctive feature is that they enable readers to learn about the content of the other two types of sources (Ibid.). Examples of derivative sources include bibliographic descriptions and bibliographies, documentation descriptions and thematic compilations (Hancko, 1972, pp. 18–26). However, in today's world, these are also abstract databases and publications, RSS channels, information bulletins, guides and other types of sources.

Open access to resources and collecting large volumes of data

One of the purposes of research libraries is to collect high-quality library resources. This implies that such institutions should create spaces where knowledge is collected and made available as part of historical collections, as well as being contained in the latest, up-to-date information sources (Materska, 2016a, p. 65). However, it should be noted that, in the case of digital sources available via libraries, the number of documents possible to be downloaded by a user for the purpose of further processing is

frequently limited. In the case of license-based databases offered by libraries, their terms of service frequently clearly specify how many sources can be downloaded (regardless of whether a discovery system, individual database interfaces or other library resources are used). Importantly, such terms of service may be relatively restrictive, depending on the library and the type of sources it offers. An example of this is the website of the Warsaw University Library, which contains a provision which states that it is permissible to download "PDF and other available files using the publisher's platform functions, but only for personal, private, scientific, educational and research use" (Warsaw University Library, n.d.). The "mass and automatic (with the use of software) downloading of files and other data" is prohibited (Ibid.).

Open access to digital resources appears to be of high importance in modern big data analyses; for example, within the context of the content of a large portion of digital libraries and repositories, as well as certain full-text and abstract databases. Naturally, the above only applies if the terms and conditions of using such sources do not impose restrictions on downloading large amounts of data. It is also important to note that the open access movement emphasizes free access to the results of publicly-funded research. This finds confirmation in the recommendation contained in the 2005 OECD Report, for example, according to which governments should recoup research costs by, among other methods, sharing research results as broadly as possible (OECD, 2005). In addition, institutions which finance research demand with increasing frequency that study results be available on an open-access basis. Such solutions are utilized by the European Commission and the European Research Council, for example. The Horizon 2020 framework program and its guidelines exemplify this approach. Open access, which is the free online sharing of research information and study data, as well as the ability to reuse them in the future, is considered by these guidelines an important aspect of the process of sharing project results (European Commission, 2018). As noted correctly by Materska (2016b, p. 51), *at the current stage the policy for open access to scientific publications is promoted as obligatory in relation to materials and data created in the process of publicly-funded research.*

In light of the above and within the context of using scientific and technical sources for the purpose of big data processing, the concept of open public sector data is also important, as is the ability to reuse such data (e.g. for research purposes). It is worth noting that the concept of sharing public data is in line with the guidelines of the European Commission (Directive 2013/37/EU of the European Parliament and of the Council, 2013; Otwarte Dane, 2018). The idea of openness applies in particular to collecting and sharing data whose creation involved public funding. Such data may be used, processed and published, provided that their source is indicated and that further distribution of content based on that data follows the same rules (Pawłoszczek, 2014, p. 456).

Summary

We are currently witnessing a gradual increase in the demand for specialists in big data analysis and processing (e.g. big data scientists, big data architects and big data analysts).⁹ This applies to structured, partially structured and unstructured data contained within scattered databases, file collections, portals, libraries, repositories and digital archives, on websites and online forums, relayed via streams, in social media and other online sources. In identifying and collecting resources, certain issues and challenges related to information science can be identified, as well as certain legal and tool-related (including IT) issues. Bibliologists, information scientists and librarians certainly possess knowledge and skills related to specialist sources of information. Moreover, librarians possess the tools to effectively facilitate the process of finding documents which are most relevant to a given search query. Their knowledge of how to identify and collect documents for the purpose of big data processing can in many cases prove invaluable.

References

- Ahmed, W., & Ameen, K. (2017). Defining big data and measuring its associated trends in the field of information and library management. *Library Hi Tech News*, 34(9), 21–24. DOI: <https://doi.org/10.1108/LHTN-05-2017-0035>
- Babik, W. (2010). O natłoku informacji i związanym z nim przeciążeniu informacyjnym. In J. Morbitzer (Ed.), *Człowiek-Media-Edukacja* (pp. 21–27). Kraków: Katedra Technologii i Mediów Edukacyjnych Uniwersytetu Pedagogicznego w Krakowie.
- Ball, S. (2013). Managing big data: what's relevant? *AALL Spectrum*, 18(2), 25–27.
- Biblioteka Uniwersytecka w Warszawie. (2019). *Zasady wykorzystania baz*. Retrieved from <https://tinyurl.com/y5eepvqz>
- Bodleian Libraries. University of Oxford. Search Oxford's Libraries Online. (n.d.). Retrieved 8.09.2019 from <https://www.bodleian.ox.ac.uk/>
- Burnet-Wyrwa, W. (2017). Big Data – wyzwanie dla rachunkowości zarządczej. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, 341, 45–53.
- Busłowska, E., & Wiktorzak, A.A. (2014). Przetwarzanie i analizowanie dużych ilości danych, *Logistyka*, 6, 2490–2496.
- Cisek, S. (2017). *Podstawy teorii i metodologii informatologii*. Retrieved from <https://tinyurl.com/y6lc7ezn>
- Clarivate Analytics. (2019). *Web of Science. Quick reference guide*. Retrieved from <https://tinyurl.com/y4u8qf6c>
- Cuzzocrea, A., Simitsis, A., & Song, I. (2017). Big Data Management: New Frontiers, New Paradigms. *Information Systems*, 63, 63–65. DOI: <https://doi.org/10.1016/j.is.2016.07.002>
- Derfert-Wolf, L. (2011). Specjalista informacji 2.0? Bibliotekarz dziedziny 2.0? Nowa forma przewodników po zasobach – LibGuides. *Biuletyn EBIB*, 119(1). Retrieved from <https://tinyurl.com/y3nbbw7>
- Drosio, S., & Stanek, S. (2017). Big Data jako źródło informacji rozszerzające funkcjonowanie systemów wspomagania decyzji w zarządzaniu kryzysowym. *Zeszyty Naukowe Politechniki Częstochowskiej. Zarządzanie*, 26, 107–120.
- European Parliament. (2013). *Dyrektywa Parlamentu Europejskiego i Rady 2013/37/UE z dnia 23 czerwca 2013 roku*. Retrieved from <https://tinyurl.com/y5l7ky78>
- European Commission. (2018). *Open Access to scientific information*. Retrieved from <https://tinyurl.com/y4tptjrw>
- Global AI Bootcamp. (2019). Retrieved from <https://tinyurl.com/y68lmsj>
- Głowacka, E., Jarocki, M., Kowalska, M., Kurkowska, E., & Pamuła-Cieślak, N. (2016). Współczesne źródła informacji. In W. Babik (Ed.), *Nauka o informacji* (pp. 189–214). Warszawa: Wydawnictwo SBP.
- Hancko, R. (1972). *Zarys wiadomości o dokumentach*. Warszawa: Centralna Biblioteka Wojskowa.
- Henke, N., Bughin, J., Chui, M., Manyika, J., Saleh, T., Wiseman, B.I., & Sethupathy, G. (2016). *Report McKinsey Global Institute. The age of analytics: Competing in a data-driven world*. McKinsey Global Institute. Retrieved from <https://tinyurl.com/yb7vytkg>
- Hoy, M.B. (2014). Big Data: An Introduction for Librarians. *Medical Reference Services Quarterly*, 33(3), 320–326. DOI: <https://doi.org/10.1080/02763869.2014.925709>
- Kim, G-H., Trimi, S., & Chung, J-H. (2014). Big-Data Applications in the Government Sector. *Communications of the ACM*, 57(3), 78–85. DOI: 10.1145/2500873
- Lubelska Biblioteka Wirtualna. (2019). Retrieved from <http://projektlbw.lublin.eu/>
- Materska, K. (2016a). Biblioteka akademicka jako element infrastruktury naukowej w cyfrowym świecie danych, informacji i wiedzy. In H. Brzezińska-Stec, & J. Żochowska (Eds.), *Biblioteki bez użytkowników...? Diagnoza problemu* (pp. 53–68). Białystok: Wydawnictwo Uniwersytetu w Białymstoku.
- Materska, K. (2016b). Aktualność koncepcji zarządzania informacją w dobie big data – perspektywa informatologa. In S. Cisek (Ed.), *Inspiracje i innowacje: zarządzanie informacją w perspektywie bibliologii i informatologii* (pp. 47–59). Kraków: Biblioteka Jagiellońska.
- McKinsey & Company, (2016). *Raport o zaawansowanej analizie danych i Big Data*. Retrieved from <https://tinyurl.com/y2px289n>
- Maślanowski, J. (2015). Analiza jakości danych pozyskiwanych ze stron internetowych z wykorzystaniem rozwiązań Big Data. *Roczniki Kolegium Analiz Ekonomicznych*, 38, 167–177.
- Nicholson, S. (2003). The Bibliomining Process: Data Warehousing and Data Mining for Library Decision-Making. *Information Technology and Libraries*, 22(4), 146–151.
- NISO, (2014). *NISO Launches Open Discovery Initiative (ODI) Standing Committee*. Retrieved from <https://tinyurl.com/y5tmtled>

⁹ Recent job market research demonstrates that there has been a gradual increase in the demand for staff possessing high analytical skills related to data source identification, big data exploration and analysis and using the results of such analyses in decision-making processes in various areas of economic activity (the demand for such specialists may grow by as much as 12% per year, and in the U.S. alone, between 2 and 4 million jobs will be created for such professionals in the following decade) (see McKinsey & Company, 2016).

Challenges Related to Identifying Sources and Document...

Organisation for Economic Co-operation and Development (OECD). (2005). *Digital Broadband Content: Scientific Publishing*. Retrieved from <https://tinyurl.com/y2a9x3pk>

Otwarte Dane. (2019). *Korzystaj z danych!* Retrieved from <https://dane.gov.pl/>

Otwarte Dane. (2018). *Portal Open Data Gotowy do wdrożenia w Twoim mieście*. Retrieved from <https://www.otwartedane.com/>

Palczna, D. (2016). *Aspekty projektowania i oceny systemów informacyjno-wyszukiwawczych bibliotek na początku XXI w.* Retrieved from <https://depotuw.ceon.pl/handle/item/1531>

Pawełszek, I. (2014). Wybrane problemy wdrożenia koncepcji otwartych danych w e-administracji. *Roczniki Kolegium Analiz Ekonomicznych*, 33, 455–470.

Płoszajski, P. (2013). Big Data: nowe źródło przewag i wzrostu firm. *e-mentor*, 3(50), 5–10.

Reinhalter, L., & Wittmann, R.J. (2014). The Library: Big Data's Boomtown. *Serials Librarian*, 67(4), 363–372. DOI: <https://doi.org/10.1080/0361526X.2014.915605>

Rodak, O. (2017). Twitter jako przedmiot badań socjologicznych i źródło danych społecznych: perspektywa konstruktywistyczna. *Studia Socjologiczne*, 3(226), 209–236.

Skórka, S. (2017). Wizualizacja nawigacji w serwisach typu discovery. *Toruńskie Studia Bibliologiczne*, 2(19), 135–161.

Sosińska-Kalata, & B., Pindłowa, W. (2017). Informatologia. In A. Żbikowska-Migoń, & M. Skalska-Zlat (Eds.), *Encyklopedia książki. T. I, A-J*. Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego.

Świgoń, M. (2018). Informatologia w analizie trendów. In A. Kucner, R. Sierocki, & P. Wasyluk (Eds.), *Trendy. Interpretacje i konfrontacje* (pp. 126–137). Olsztyn: Uniwersytet Warmińsko-Mazurski w Olsztynie.

Tabakow, M., Korczak, J., & Franczyk, B. (2014). Big Data – definicje, wyzwania i technologie informatyczne. *Informatyka Ekonomiczna*, 1(31), 138–156.

TQMOSOFT, Czarski, A. (2018). *Jaką nową wartość dla firm wnosi Big Data?* Retrieved from <https://tinyurl.com/y24pojed>

Tuppen, S., Rose, S., & Drosopoulou, L. (2016). Library catalogue records as a research resource: introducing 'a big data history of music'. *Fontes Artis Musicae*, 63(2), 67–88.

Villanova University. (2019). *Falvey Memorial Library*. Retrieved from <https://library.villanova.edu/>

Wójcik, M. (2016). Big data w zarządzaniu informacją – przegląd wybranych zagadnień. In S. Cisek (Ed.), *Inspiracje i innowacje: zarządzanie informacją w perspektywie bibliologii i informatologii* (pp. 61–70). Kraków: Biblioteka Jagiellońska.

Żemła, E. (2018). *Analitycy Big Data – współcześni wróżbici? Niezwykły projekt polskich naukowców*. Retrieved from <https://tinyurl.com/y2j9w57r>

Abstract

The modern information environment is dynamic and characterized by the speed with which multimedia content is created, collected, contributed to and shared. Users have access to documents which are part of large, changing and diverse sets of data, whose effective processing can lead, and frequently does lead, to new knowledge being discovered. However, the overwhelming majority of the resources available today require specialized tools and techniques for identifying, searching, collecting and organizing the large volumes of data. This also applies to data directly related to the activities of institutions dealing in information or the field of information science, especially the theory and practice of accessing, searching and collecting documents.

The purpose of this article is to present selected issues and challenges related to exploring the possibilities offered by big data from the perspective of information science, the activities of libraries and the information resources they offer. Based on a critical analysis of the relevant literature and with use of inductive reasoning, experiments and observations, selected aspects of digital document accessibility and classification are presented, in addition to issues related to searching and identifying resources using tools currently offered by libraries (in particular discovery systems).

Keywords: big data, data management, trend watching, information science, data sets exploration

Grzegorz Gmiterek (Doctor of Humanities in the field of book studies and information science) is Adjunct at the Faculty of Journalism, Information and Book Studies of the University of Warsaw. His research interests focus on the applications of new technologies in cultural and science institutions (in particular the tools and services of Web 2.0, as well as mobile devices and applications). He is a recipient of a scholarship granted by the Dr Maria Zdziarska-Zalezka History and Literature Association in Paris, as well as a participant in the US Department of State International Visitor Leadership Program "Library & Information Science." He is the author of several dozen publications, including the book *Biblioteka w środowisku społecznościowego Internetu. Biblioteka 2.0 (The library in the social internet environment. Library 2.0, 2011)*, for which he received the Adam Łysakowski SBP Science Award, as well as being the co-author of the book *Aplikacje mobilne nie tylko w bibliotece (Mobile applications not only in the library, which received a technical and science publication award of the Rector of the Warsaw University of Technology at the ACADEMIA Academic and Science Book Fair)*. For the past two years, he has been working on the research grant *Exploring sources of data on the topic of R+D+I activity*, awarded by the National Center for Research and Development.

The Role of Motivation in the Self-education of Future Teachers



*Irina Dubrovina**



*Kateryna Horash***



*Tetiana Radzivil****



*Tatiana Oliynyk****

The current transformations conditioned by the transition to an information society in Ukraine has led to the incipience of a new paradigm, one characterized by the redistribution of the emphasis on self-education (Kolb, 1984, p. 256). The intrinsic social demand for the qualifications of teachers in the future determine the priority for the needs of their self-education process. The system of higher education conditions continuous professional development in terms of the scientific and methodical background necessary to improve their basic pedagogical competencies.

The following pedagogical competences have already been studied: professional (Shevchuk, 2001, p. 398), pedagogical (Bezdukhov, 2002, pp. 66–71), psychological (Kuzmina, 1970, p. 114), social and perceptive (Yershova, 2016, p. 250), cultural and ethical (Kotlyarova, 2012, p. 230), communicative (Kuzovlev, 1999, p. 50), and self-educative (Ermakov, 2006, p. 219). These researchers considered the self-education of teachers to be an effective transforming force in education and society as a whole.

The European guidelines and regulations of competence development state that teachers must receive an efficient and relevant qualification implying, among other things, continuous lifelong learning and mobility (Woodfolk, 1989, p. 220). The key pedagogical competencies include an ability to interact with other people, knowledge, technology and information; both with and within society (Loughran, 1994). The new State Standard of Basic and Complete Secondary Education in Ukraine created new demands for future teachers training in their respective professional areas in accordance with the educational programs of training specialists of a new type who are ready to implement innovative changes into their professional activities (Ministry of Education and Science of Ukraine, 2013). To study the problem of motivation development and stimulation

of self-education among future teachers the authors have used a number of scientific methods, namely: analysis of the curricula and programs; conducting surveys, questionnaires and interviews; individual and group assessment of teachers in oral and written forms; expert judgement on the creative and academic tasks comprising professional training courses; and the qualitative and quantitative processing of the obtained experimental data.

The study involved 304 undergraduates in the third year of their studies for a BA in music teaching, and took place at the National Pedagogical Dragomanov University (Kyiv, Ukraine), Musicology Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University and Pavlo Tychyna Uman State Pedagogical University (Uman, Ukraine). The study was carried out in 2016–2018.

Study procedure

- 1) Development of a set of evaluation criteria and diagnostic tools for determining the initial level of student self-education.
- 2) Diagnostics of the initial level of self-education among the future teachers in the process of pedagogical practice.

We made the assumption that the efficiency of the self-education of future teachers would increase significantly if:

- 1) A special, systemic approach based program was developed, which integrated educational and methodological activities focusing on the harmonization of structural components, integrity, level-based structure and dynamism.
- 2) The role of motivation in the self-development of future music teachers was determined, a necessity in the obligatory stimulation of student motivation in terms of self-education as the pedagogical condition of its organization.

*National Pedagogical Dragomanov University, Ukraine

**National Academy of Educational Sciences of Ukraine

***Pavlo Tychyna Uman State Pedagogical University, Ukraine

The Role of Motivation in the Self-education of Future...

The study had the following objectives:

- 1) To suggest a set of evaluation criteria and diagnostic tools for determining the level of self-education development of the future music teachers.
- 2) To conduct an experiment to determine the initial level of self-education development of the future music teachers.

The study participants were divided into two groups: experimental and control. The study involved 304 future teachers (148 in the experimental group, 156 in the control group). The authors studied 6 groups over a two year period. The experimental group (EG) was used to check the effectiveness of self-education motivation. Active mentoring and guidance in their self-education were used in this group. Participants of the control group (CG) had to acquire the structure and content of self-education during the 'natural' flow of the educational process at their respective higher education institutions, without any external stimulation. Mentoring and guidance in their self-education were not used, and they only attended lectures and seminars on different issues of self-education. At the initial stage of the study, the authors created a set of diagnostic tools to determine the level of self-education development. The following methods and tools were used to achieve the interim goals: pedagogical observation of the self-education activities; conversations with the teachers and lecturers; and querying of teachers with the aim of identifying the indicators to define self-education development (Table 1).

The questionnaire *The presence of motivation for self-education* (Andreev) contained such questions as: 'Should modern music teachers improve their skills?', 'Are you engaged in self-education activities in full', 'Do you take part in professional competitions and scientific conferences?', 'Do you consider your level of culture and education sufficient?', 'Are you engaged in self-analysis of your self-educational activities, to analyze your strengths and weaknesses?' and 'Do you think that a music teacher is a creative profession?'. The respondents could answer 'yes', 'rather yes' or 'no'.

A questionnaire designed by Kettel was abridged for this study to determine self-education motivation, containing 31 statements used to identify the attitude to self-education, the main factors contributing to the level of self-educational development, and those typical (both external and internal) barriers to effective self-educational activities. The questions included: 'Do you think that people are not restricted in their professional self-development?', 'Do you always try to find time for self-education in spite of your everyday activities?', 'Do you agree with the statement that people should be engaged in self-education during their whole life, regardless of age and profession?', 'Do you actively use the Internet for self-education and communication with colleagues?', 'Do you systematically acquaint yourself with the scientific papers on pedagogy and psychology?', and 'Do you study foreign languages to communicate with foreign colleagues?'. The respondents could choose one of the following answers: 'the statement fully corresponds to reality', 'the statement rather corresponds to reality', and 'the statement does not correspond to reality'.

To determine the level of self-education development, the authors used questionnaires and surveys. These methods took into account all their possible advantages and disadvantages, in both EG and CG. Each method included surveys, tests, exercises, projects, business games and situation management. Each completed task was evaluated on a 5-point scale: 2 points – completed up to 40%, 3 points – 41–60%, 4 points – 61–80%, 5 points – 81–100%. For processing of the questionnaire results, the following distribution of estimates was used: if the appropriate quality and type of activity were constantly observed in a participant then they were awarded 5 points. In case of a partial, but not frequent violation of this requirement, 4 points. If the investigated quality was rarely or occasionally observed, 3 points. The complete absence of the quality in the characteristic, 2 points. Each indicator allocated in a certain component was evaluated according to the degree of its manifestation in the participant. The coefficient of indicator development was calculated as follows: $L = A + B + C$,

Table 1. Determining the level of motivational and value component development as a part of the self-education of the future teachers

Research methods	Research tools	Indicators to be defined
<ul style="list-style-type: none"> • Personal query • Group query • Analysis of written work • Interview 	<ul style="list-style-type: none"> • Questionnaire: <i>The presence of motivation for self-education</i> (Andreev) • Questionnaire by Kettel 	<ul style="list-style-type: none"> • Relationship between self-education with the personal and professional interests • Motivated focus on self-development and mastering innovative techniques in artistic pedagogy • Understanding of need in acquiring scientific knowledge • Desire to become a skilled and reputable professional

Source: authors' own study.

where: L – criterion of the self-education level; A – first component indicator score; B – second component indicator score; and C – third component indicator score. Empirically the authors identified the following limits in the levels of self-education development by the participants: low – 2.0 to 3.0 (up to 41%); medium – 3.1 to 4.0 (41–80%); and high – 4.1 to 5 (81–100%). A diagnostic toolkit was developed for the study to show the level of self-education development for the participants. The following methods were used for this stage of the study: personal and group querying; analysis of essays and other written work; conversation; pedagogical observation of the results of the participants' self-directed work; interviews; surveys to identify the indicators for self-education component development.

The diagnostics were intended to detect the following indicators: the relationship between self-education and personal/professional interests; motivated focus on self-development and mastering of innovative techniques in artistic pedagogy; understanding of the need to acquire scientific knowledge; and the desire to become a skilled and reputable professional. The study tools included: the *Presence of motivation for self-education* questionnaire, the *Study of the levels of self-education component development* questionnaire and the *Development of a positive attitude towards self-education in a professional* questionnaire (Andreev, 2002, p. 608).

Most respondents related their motivation for self-education to their professional growth, proving that they view the motives for self-education as quite important (see Table 2).

The study in terms of the problem of motivation and stimulation of undergraduate students show that the future teachers must acquire the following qualities for the organization of effective self-education: self-confidence, independence of judgment, ability to use the experience of other colleagues, ability to cooperate, and ability to defend a point of view.

It was ascertained that most of the participants did not have formed motives for self-education (66.2% CG

and 70.3% EG). Only a small segment of the respondents (5.6% CG and 7.1% EG) showed an interest in self-education together with the activation of motivation for the activity studied.

It was substantiated that most students carry out self-education activities, mainly spontaneously, focusing on intuition and professional-pedagogical difficulties that require solving. In essence, the respondents set their goals for self-education activities unknowingly, and did not select the means of their implementation, which leads to a discontinuity in self-education activities. The participants preferred framed educational activities during classroom work, reducing the possibility of independent cognition. The analysis of the participants' self-education status often revealed the absence of such components as looking for the causal relationship among the initial and the current state of the object. The analysis of the management orientation of self-education, as well as its correcting and designing functions, were not fully understood (Lave & Wenger, 1991, p. 132).

Diagnosics of the level of student self-education

We used a set of diagnostic tools and techniques that included the *Identification of the teachers professional complications in the process of their self-education* questionnaire, a summary of each participants' personal self-educational experience, a *Study of the components of self-education* questionnaire, a *Diagnosics of the level of readiness for the teaching profession and self-development* questionnaire, and pedagogical observation of self-education implementation (Fetytskin, Kozlov & Manuilov, 2002).

These techniques allowed us to identify the level of self-education development of the future teachers, based on the self-assessment of the indicators of the components (motivational and value) development. The respondents selected the indicator with the help of a nine-point scale (0 to 9 points). The data for each

Table 2. Motivation for self-education in future teachers

No	Contents of the motives	CG	EG
1	Realize the need to teach children	12.7	14.7
2	Enhance the professional skills	32.8	31.0
3	Master the modern pedagogical ideas and technologies	24.8	24.3
4	Realize their creative potential	18.9	19.2
5	Not to lag behind their colleagues in terms of professional level	34.1	32.8
6	Ensure quality of educational activities	19.7	20.6
7	Gain the respect of their future colleagues	21.9	22.8
8	Gain the respect of their students	34.2	35.1
9	Avoid concerns with the authorities	12.7	11.8
10	Gain intellectual pleasure	10.5	9.7
11	Gain respect of the students' parents	13.8	13.2

Source: authors' own study.

The Role of Motivation in the Self-education of Future...

factor were summed and used to determine the initial level of self-education development.

Two matrices were completed for each student: self-assessment and expert assessment, which were then analyzed. Each answer in the questionnaire was expressed in points, which were used as follows: the points were obtained for each direction (a, b, c, d, e) and compiled. This allowed us to calculate five averaged data points in each questionnaire. First – the averaged value determined the level of development in each section of self-education. Second – the value provided data on self-education activities in general. Third – the personal-style qualities of self-education. Fourth – the dynamic properties of self-education. Fifth – the general averaged value, which consisted of the sum of the previous ones. From this data the parameters of self-education were formed.

The analysis of the classification of educational systems (technologies) according to the type of organization and management is significant in the studies conducted by Bepalko. Using empirical research as a basis, he suggests a coefficient scale (ranging from zero to one) to measure the process of learning information acquisition (Bepalko, 2012). The study proved that successful assimilation of learning information takes place only when the assimilation coefficient takes a value between 0.7 and 1.0. If the coefficient is lower than 0.7 there is no evident result of learning.

To determine the indicators of motivational and value component development among the future teachers in CG and EG, pedagogical observation (in the process of continuing professional development, concert performances, scientific-practical conferences, qualification exams) and individual consultations were carried out. When determining the level of self-education based on the motivational and value component, attention should be paid to the nature of the professional difficulties of the future teachers in the process of organizing their self-education (Pask, 1976).

The participants completed a questionnaire to achieve this objective, and the issues related to the study of the motives of self-education were analyzed. The following questionnaires were used: *The presence of motivation for self-education* (Andreev, 2002) and *Forming of a musical art teacher's positive motivation for self-education*. As shown by the analysis of the results of the questionnaires, most participants in both groups (56.3% CG and 59.3% EG) were engaged in self-education as a matter of "necessity". Some of the participants (35.4% of CG and 31.9% of EG) gave a negative answer to the question: *Do you self-analyze your self-education activity, do you discover your strengths and weaknesses?* A total of 8.3% of the CG participants and 8.5% of the EG believed their level of self-education activity was *insufficient for the profession of music teacher*. The other questions used in the questionnaire were: *Do you like the profession of teacher? Are you motivated enough for continuing professional development? Should a modern teacher constantly improve their skills? Do you consider a teacher to be a creative profession?* Most of the

CG participants (93.8%) and (95.7%) gave a positive answer, which demonstrates that they understood the need for self-education.

The nine-point scale was used to measure personal skills and qualities that correlated with three components of the participants' self-education. The motivational and value component was evaluated in questions 1 to 10. Use of self-assessment as an objective indicator did not contradict the nature of the study, because we were interested in a very subjective aspect – the attitudes of future teachers to self-education.

We used the following scale to process the results: prevalence of scores 1, 2, 3 – a low level of self-education; prevalence of scores 4, 5, 6 – an average level of self-education; prevalence of scores 7, 8, 9 – a high level of self-education. In order to choose appropriate diagnostics tools we analyzed the diagnostic procedures required to determine the formation of some individual self-education skills, as well as knowledge in the field of self-education as developed in the psychological and pedagogical studies by Serikov (1985, p. 137), Slastonin (2002, p. 512), together with the "Personality map" method by Platonov (1986, p. 256). Analysis of the procedures for determining the level of self-education leads to the assumption that the diagnostics in the majority of them are developed in the form of a questionnaire to identify the products of self-education.

We systematically carried out pedagogical observation of the participants' self-directed learning. As the products of self-education activity, we selected topics from the abstracts and reports of scientific and practical conferences. As a result of the pedagogical observation, it was observed that when choosing topics for the abstracts and reports, the participants often asked their trainers to "recommend" or "advise" in their choice of study topic, which indicates the absence of a link between self-education and professional interests. The method of conversation with the participants allowed us to confirm the results of the written responses; in addition, expanded questions and arguments were provided verbally. The levels of self-education were assessed according to the identification of the orientation of an individual, their creative potential, and components of social or active action. A total of 61.7% of the CG participants and 60.6% of the EG gave the following set of reasons *that led to their lack of active self-education: lack of sufficient pedagogical experience, lack of time due to educational overload, lack of living conditions, limited access to scientific information, and weak financial and moral support*.

The need for a mentor's leadership in self-education was stated by 68.9% of the CG participants and 66.2% of the EG, while 19.1% of the CG and 20.3% of the EG participants expected support from the school administration, and 17.8% of the CG and 19.6% of the EG needed the setting of self-education activities by authoritative bodies. Half of them self-educated continuously and versatility. Both direct and indirect connections can be observed: long self-education leads to

a variety of ways to use the results of self-education activities. One more motive that affects the level of self-education is the leadership value of a teacher for their students. This motivation is a leading one, and in the hierarchy of motives it had a dominant role among the participants.

Research results

The essence of self-education is overcoming the gaps in professional training; therefore, their self-education is aimed at the same disadvantages that they see in themselves or which their colleagues point out. If teachers emphasize the complex nature of self-education, then the motivation is complex, with: a need to improve their training, a need for self-affirmation, and a desire to expand their general and scientific outlook.

Discussion of the results

The study revealed the following reasons for a lack of effectiveness of self-education among all the participants, regardless of their essence, category, motive and incentive:

- lack of time (indicated by 68.4% of the CG participants of the CG and 75.5% of the EG),
- lack of scientific knowledge (24.7% of the CG and 22.8% of the EG),
- lack of material incentives (15.7% of the CG and 17.5% of the EG).

These reasons are more intrinsic and socially typical than subjective and personal, dependent on individual attitudes of specialists to their profession. As they gain experience, the difficulties in self-education increase in connection with the emergence of a social cause – the need for some additional earnings.

While analyzing the responses to the questionnaires, we noticed that improvements in the organization of self-education is added by access to scientific information, which involves scientific discussions on the actual problems of pedagogy and psychology, cooperation with researchers and practice innovators, and access to relevant scientific and methodical literature (Levin, 2003, p. 309).

As a rule, future teachers with strong volitional qualities and rich professional experience choose

a policy which involves risk and forcing of creative resources in the process of implementing non-standard decisions. This affects the peculiarities of the motives structure (Nystrand & Gamoran, 1991).

Due to the increase in effectiveness of the self-education motives and incentives in the educational environment, the arranging for the essence of self-education also changes. This reduces the number of highly professional educators (13.2% of the respondents of the CG and 15.7% of the EG) who believe that self-education is a complex phenomenon with a set of specific motivations: the need to improve the general and methodical culture, the desire to become a master of their work, an awareness of self-education as a personal value, and the need to eliminate the gaps in the field of pedagogy and psychology.

A total of 13.5% of the CG and 14.1% of the EG participants engaged in creative activities at scientific conferences, readings or methodical seminars as a stimulus for their self-education. This is connected with the fact that the future teachers aim not only to enrich their professional ability, but also to transfer their experience to the others, test it, and analyze it from the standpoint of their colleagues. In this way creative self-expression can take place. If the teachers understand self-education to be a comprehensive professional self-improvement process, then their motives are connected with each other, and motivation becomes complex. In other cases the dependence of the motives on understanding the essence of self-education was not fixed. The participant's assessment (the core stimulus) and self-affirmation in their environment through partnership with the curator of a group (the leading motive) are directly related to each other. The above-mentioned stimulus also works in a complex of motives. The remaining motives and stimuli are separated and do not significantly affect the self-education activity. Taking this into account, it is important to determine the method for methodical tools in connection of the motives and stimuli of self-education activity in the system of higher education.

As a result of the diagnostic procedures and processing of the mathematical data, the results we obtained according to the motivational and value component of the participants are reflected in Table 3.

Table 3. Summarized results of the level of self-education development according to the motivational and value component

Points	EG		CG	
	Number of creative tasks performed	%	Number of creative tasks performed	%
5 points	–	–	–	–
4 points	34	10.12	39	11.21
3 points	101	30.06	110	31.61
2 points	201	59.82	199	57.18
Total	336	100	348	100

Source: pedagogical observation of organization of self-education activity, based on (Fetytskin, Kozlov & Manuilov, 2002).

The Role of Motivation in the Self-education of Future...

Based on data in Table 3 we can define the average result according to the formula, for both CG and EG:

$$H_n^o = \bar{x}_n = \frac{1}{n}(x_1n_1 + x_2n_2 + x_3n_3 + x_4n_4 + x_5n_5) \quad (1)$$

where

H_n^o – a generalized level of self-education development in future teachers according to the motivational and value component;

x – arithmetic average;

x_i – points scored;

n_i – repeatability of the points;

n – number of participants in a group.

Consequently, the generalized level of self-education development based on the motivational and value component of the participants' activities (arithmetic average) in the CG is 2.5 and in the EG is 2.54 points. In general, before the study began it was 0.8% lower in the CG than in the EG, which is insignificant. The analysis of the data in the table shows that the participants had the following arithmetic average scores: a motivational and value component of self-education in the CG of 2.5 points (50.0%), with a motivational and value component in the EG of 2.53 (50.8%). The determined indicators evidence that the motivational value component of self-education of the participants in the CG is 50.0%, and in the EG is 50.8%. These are the mid-level indicators.

To confirm reliability of the data we applied the Pearson correlation and calculated it by formula 2:

$$\chi_0^2 = \sum \frac{(n'_e - n'_k)^2}{n'_k} \quad (2)$$

where

n'_e – indicators of the EG;

n'_k – indicators of the CG.

The calculated Pearson correlation, according to the motivational and value component, is 7.79. The value of the Pearson correlation is 9.49 with a level of significance of 0.05, fluency degree of 4.

Analysis of the study data

If the self-education of students is not the aim of the learning process, their spontaneous mastering of this skill does not occur. The knowledge, operations and actions in relation to self-education must be taught specifically, requiring the creation of the necessary pedagogical conditions.

Possible methods of motivation and stimulation in self-education development

1. Diagnostics of the motives for self-work with the aim of establishing a leading motive or complex of motives, the main stimulus that can increase motivation for self-education.

2. Individual motivation and stimulation of the self-education of future teachers, in which the leading motives and the main stimuli are interrelated, support each other, activate some other motives and stimuli, enriching motivation and forming comprehensive stimulation. The following connection options are possible: the specific leading motives and stimuli (direct connection), the leading motive and a complex of some stimuli (mediated connection), the main stimulus and a complex of some motives, a complex of the motives and a complex of stimuli.
3. The transition of the external process of motivation and stimulation into the internal process of self-management and self-regulation. The pedagogical influences in the system of higher education, reinforcing this or that stimulus, provide self-stimulation and indicate a qualitatively new level of self-improvement.

Thus the method for increasing the effectiveness of motivation and stimulation for the self-education activity of future teachers in the process of pedagogical practice is related to acquiring and actualizing subjective experience, a search for the connections between subjective experience and experience given from the outside. The result of this, above all, is the ability to learn and gain specific knowledge and skills. Therefore, self-education can be defined as an activity of self-movement, self-change, self-development; the acquisition of their own life experience, which is modeled in self-education activities by assigning the elements of general practical experience. The forming of pedagogical experience requires some special skills in organizing self-education – the identification of information, definition of its structure, analysis, systematization and selection of actual content etc.

Thus, based on an analysis of the scientific literature, we determined the following abilities of the future modern teacher to increase the effectiveness of their motivation and stimulation for self-education: independence, organization, purposefulness, systematic, multidimensionality, plurality of activity, self-learning skills, individualization, subjectivity, etc.

The data shown in the paper was developed using all the described research tools.

It is worth mentioning that this paper presents only part of the original experiment. This is due to the desire to express the conceptual idea of the study reflexively within the framework of a scientific article. The study does not include all the aspects of the problem under consideration; however, it allowed us to determine some possible routes for further research. Thus, the content of future music teachers' self-education, as well as its forms, methods and tools, require additional practical and theoretical research.

References

- Andreev, V. (2002). *Pedagogy: training course for creative*. 2nd ed, Kazan: Center of innovative technologies.

Bespalko, V. (2012). Tests in education: to be or not to be. *School technologies: scientific-practical Journal*, 1, 3–9.

Bezdukhov, V.P. (2002). The antinomy of adaptive and humanistic functions of pedagogical activity. *Pedagogy*, 9, 66–71.

Fetyskin, N., Kozlov, V., & Manuilov, H. (2002). *Socio-psychological diagnostics of the personality and small groups development*. Moscow: Publishing House of the Institute of Psychotherapy.

Kolb, D. (1984). *Experiential Learning: Experience as a Source of Learning and Development*. New Jersey: Prentice Hall.

Kotlyarova, I.O., Serikov, G.N., & Tyagunova, Y.V. (2012). *Design of educational and scientific process at the university*. Chelyabinsk: YuURSU.

Kuzmina, N.V. (1970). *Methods of research of pedagogical activity*. Leningrad: Publishing house of Leningrad University.

Kuzovlev, V.P. (1999). *Professional training of students at the Pedagogical Institute* (Unpublished doctoral dissertation).

Lave, J., & Wenger, E. (1991). *Situated learning. Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Levin, B. (2003). *Case Studies of Teacher Development: an in-depth look at how thinking about pedagogy develops over time*. Mahwah, NJ: Lawrence Erlbaum Associates.

Loughran, J.J. (1994). Professional development for science teachers: a school based approach. *Science Education International*, 4(4), 25–27.

Ministry of Education and Science of Ukraine. (2013). *State standard for basic and complete secondary education*. Retrieved from <http://zakon4.rada.gov.ua/laws/show/1392-2011-%D0%BF>

Nystrand, M., Gamoran, A. (1991). Student engagement: When recitation becomes conversation. In H. Waxman, & H. Wahlberg (Eds.), *Contemporary research on teaching* (pp. 257–276). Berkeley: McCutchan.

Pask, G. (1976). Conversational techniques in study and the practice of education. *British Journal of Educational Psychology*, 46(1), 12–25. DOI: <https://doi.org/10.1111/j.2044-8279.1976.tb02981.x>

Platonov, K. (1986). *The structure and development of personality*. Moscow: Science.

Serikov, H. (1985). *Education as a condition of self-training for professional activity*. Irkutsk.

Shevchuk, L. (2001). *Development of professional competence of teachers of special disciplines of vocational education institutions in the system of postgraduate education* (Unpublished doctoral dissertation).

Slastonin, V., & Isaev, I. (2002). *Pedagogy: a manual for students of pedagogical institutions*. Moscow: School Press.

Woolfolk, A. (1989). Graduate Preparation of Teachers: The Debate and Beyond. In A. Woolfolk (Ed.), *Research Perspectives on the Graduate Preparation of Teachers*. New Jersey: Prentice Hall.

Yershova, N. (2016). *Models and methods of decision theory*. Dnipro: PGASA.

Abstract

The research work described in the present study focused on the connection between self-education and the personal and professional interests of prospective music teachers; the role of motivation on self-development; the importance of developing in students the desire to gain scientific and professional knowledge, as well as to become familiar with innovative professional practices. It was observed that for the majority of the participants motivation for self-education was associated with their professional growth. To achieve effective self-education, undergraduates must possess the following qualities: self-confidence, independence of judgment, the ability to use the experience of their colleagues, the ability to cooperate, and the ability to defend their point of view. The suggested methodology of motivation and stimulation of future teachers' self-education in the process of teaching practice is associated with the acquisition and updating of subjective experience, the search for links between internal and external experience.

Keywords: self-education, positive motivation, diagnostics methods, motivational and value component of self-education, subject specific knowledge

Irina Dubrovina, Ph.D. in Pedagogy, is an associate professor at the Pedagogical Creativity Department of the National Pedagogical Dragomanov University. She is the author of 60 and co-author of 6 research works, including monographs, educational, research and methodological manuals, research articles in professional journals, specialized courses, curricula and test tasks for students of higher education institutions. She also has experience in teaching at pre-school, secondary and higher education institutions, as well as institutes of postgraduate pedagogical education. She has spent 20 years building her overall experience in teaching and carrying out scientific research. She collaborates with the publisher of Polish scientific journal, *Nauczyciel i Szkoła*.

Her research interests cover several areas, and include theoretical and practical problems of educational innovations, forecasting the development of educational processes and systems, and innovative methods and techniques for teacher training and retraining. She also cares about supporting her students in their educational efforts, their self-development and self-improvement. She holds the position of secretary of the journal "Ridna shkola" (under the patronage of the Ministry of Education of Ukraine).

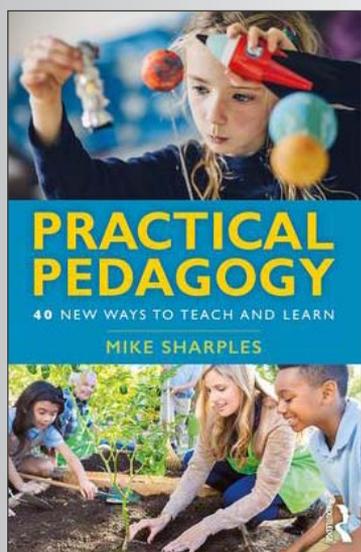
The Role of Motivation in the Self-education of Future...

Kateryna Horash, Ph.D. in Pedagogy, is a senior researcher at the Institute of Pedagogy of the National Academy of Educational Sciences of Ukraine. She also has experience teaching in pre-school, secondary and higher education institutions, as well as institutes of post-graduate pedagogical education. She has 30 years overall experience in teaching and scientific research.

She has participated in numerous research projects carried out by the Institute of Pedagogy of the NAES of Ukraine. Currently she is working on the Organizational and Pedagogical Principles of Designing the Educational Environment of an Upper Secondary School; applied research. State registration number: 0116U003185. The timeframe of the study is 2019–2021.

Tetiana Radzivil, Ph.D. in Pedagogy. She works as an Assistant Professor at Pavlo Tychyna USPU (Ukraine). She has great pedagogical experience and also engages in scientific research in this field. She is a winner of international competitions for instrumentalists (Ukraine, Poland, Italy, Serbia).

Tatiana Oliynyk, Ph.D. in Pedagogy. She works as an Assistant Professor at Pavlo Tychyna USPU (Ukraine). In 2001 she became involved in scientific and pedagogical research, which has remained her area of scientific interest since then. The particular areas of her scientific interests are musical art, pedagogy, musical-pedagogical education, and instrumental performance. Tatiana also puts great effort into preparing her students for scientific research.



WE RECOMMEND

Mike Sharples, *Practical pedagogy. 40 new ways to teach and learn*

The paradox of pedagogy is that humans can't stop learning – yet we often find it hardest to learn what others want to teach us. The education system of schools, colleges and universities has evolved over centuries to provide a foundation of knowledge and skills that are needed in society and the workplace. But sitting young people in a classroom, instructing them in times tables or chemical elements, then examining them on their recall of this knowledge, is a highly inefficient way of preparing them for life. So, what are the alternatives?

In the book you will find descriptions of new pedagogies, account of how they are being applied in practice, evidence of their success and discussion of their scope and limitations. Some may be familiar, but the book will show how they are being adopted in new ways for a digital age... They are organized around six themes: Personalization, Connectivity, Reflection, Extension, Embodiment and Scale.

Excerpts from the book (p. 4 and 5)

Publisher: Routledge, Abingdon and New York, 2019

More information at <https://www.routledge.com/Practical-Pedagogy-40-New-Ways-to-Teach-and-Learn-1st-Edition/Sharples/p/book/9781138599819>



The Identity of Young Adults and their E-learning Performance

Wioletta Kwiatkowska*

One of the consequences of the civilizational changes known as liquid modernity is that contemporary humans can experience a virtual reality. Traditional reality, as a result of social and cultural changes, has lost its importance as the leading factor responsible for creating and reinforcing the identities of 21st century individuals. Michel Foucault's (2005) claim that we live in a time of relocation, where young people shape their own identities, thus appears to be valid. Young people no longer exclusively navigate the real world – they look for cultural patterns and points of reference in the virtual one as well. The use of e-learning in higher education is not only inevitable, it also offers new educational opportunities. The virtual world erodes communication and interpersonal barriers, resulting in learners displaying hitherto unknown behaviors and entering into new relationships, which has an impact on how their identities develop.

Introduction

The purpose of the study was to collect information on the impact of the identity statuses of students on their academic performance, depending on their chosen form of learning. Marcia's (2002) identity development model was considered optimal for assessing the impact of personality on the performance of students utilizing e-learning methods. The newly-acquired knowledge may serve as the basis for solving already identified or partially-identified issues, as well as those which may arise in the future in the field of online education. It is the author's belief that the study constitutes a significant contribution to the rational and methodically-sound use of the internet in order to facilitate learning. Use of the internet in this way minimizes the flaws and optimizes academic performance. Although studies on e-learning are varied, they commonly overlook the incredibly important personal and pedagogical dimension, the relevance of which should not be underestimated. There is an urgent need to expand the theoretical and empirical body of knowledge to include analyses of the identities of e-learning group members, and to determine their

impact on the learning process. No studies have so far been conducted on the issue with reference to the form of learning, meaning that relevant empirical analyses are required. Other factors necessitating such research include changes in the life standards, values and needs on which young people base their actions.

Theoretical basis for the study

A theoretical and research-relevant niche exists with regard to the impact of the identity statuses of students on their academic performance. Individual personality statuses have been studied in relation to the role of the teacher or even in the social context (Brzezińska, 2000, 2003; Cuprjak, 2007); however, no empirical studies have been conducted with reference to e-learning, and no trends identified regarding the particular identity statuses being displayed. As a consequence, this knowledge is absent from the theories being developed on how to design effective e-learning environments.

This issue is particularly relevant for research into the online teaching process within the context of the role of learners, research which has been conducted in various countries for many years (Perraton as cited in Schlosser, Anderson, 1994; Saba, 2003; Moore, 2007; Kerr, Rynearson and Kerr, 2006; Rovai, 2004).

How an identity is constructed is determined by factors present in the sociocultural environment, which require constant adaption, negotiation and decision making based on current circumstances (Wróblewska, 2011, p. 176). Technological progress has resulted in humans simultaneously functioning in both the real and virtual worlds. According to Marcia's theory, four identity statuses exist: diffusion, foreclosure, moratorium and achievement. The first applies to those who plan for the short-term, experience difficulties in making decisions (solving problems), are not involved in serious life activities, are driven by personal gain and satisfaction, and are yet to experience an identity crisis. The second status involves making decisions

* Nicolaus Copernicus University, Poland

The Identity of Young Adults and their E-learning Performance

with reference to an authority figure (parent, teacher, idol), involvement determined by the behavior and decisions made by that authority figure, stress resulting from having to function without the value criteria of the authority figure and no identity crises. Moratorium involves being able to see alternatives but not to make decisions, a lack of full commitment and clear direction in personal explorations, looking for a compromise between social pressure and one's own preferences; the individual begins to experience an identity crisis. The final status, achievement, involves creating one's own future in accordance with one's own preferences, making independent decisions, with involvement matching one's abilities, resistance to outside influence and being able to cope with hardships, constituting a positive resolution of an identity crisis (Cuprjak, 2013). The above indicates that the issue of assessing the maturity level of a learner's identity is an important one, albeit difficult to study. However, it is an important challenge to overcome within the context of performance for online and in-class learners.

Methodological basis for the study

The main goal of the study is to verify Marcia's identity status model and its four identity statuses, with reference to online education, and to test the validity of applying it to e-learning performance. Thus, the following questions arise:

1. What is the distribution of the academic performance of students by identity status?
2. Is there a relation between the identity status of a learner and their academic performance using in-class and e-learning methods?

A pilot study was conducted in the summer semester of the 2017/2018 academic year. It focused on one group of students – referred to as *emerging adulthood*, i.e. those who have not yet made the commitments characteristic of adults. Students of teaching were selected, as it was possible to develop a customized syllabus, online course and tests for them. The participants were selected randomly, the main criterion being participation in the education theory e-learning course. The purpose of the project was to evaluate what was required to better identify the characteristics of e-learners.

The goal of the pilot study was to operationalize the research problem clearly, verify the research tools, specify the organizational and technical requirements of the study and analyze the empirical material collected. The study was quantitative in nature, and

involved the following research methods: knowledge test and diagnostic poll (Identity Status assessment questionnaire). Nonprobability sampling was used during the first stage, the primary criterion being the use of e-learning methods. The participants were full-time, first-cycle students of teaching at the Nicolaus Copernicus University. A total of 50 students expressed interest in participating; however, due to erroneously coded tests and a failure to return them, the final sample size was 47. In the second phase, random number tables were used for random sampling, with 23 participants being assigned to the experimental group and 24 to the control group. The average age was 20, and women comprised 95% of the participants. Education-related programs are selected predominantly by women.

The participants were then assessed with regard to their identity status. For that purpose, the Identity Status assessment questionnaire developed by Magdalena Cuprjak was used. According to the author of the questionnaire: *The test is based on Cosgrove's forced choice technique (Brzeziński, 1978), where an ipsative assessment is conducted by ranking answers to every problem (in this case, four answers are provided to match the four identity statuses). A psychometric profile is created based on the partial results, enabling us to determine which of the statuses is dominant in relation to others* (Cuprjak, 2013, p. 216). In the second part of the study, the participants had to study for an entire semester using online and in-class forms to minimize the novelty effect. A knowledge test was administered at the end of each module (3 topics). The participants were tested four times.

Before administering, the tests were optimized for their difficulty, discriminatory ability and reliability (Niemierko, 1999, pp. 152–160). The tests used in the study were constructed properly from the teaching perspective. A group rotation took place after the first two tests. The final stage involved determining the impact of the variables on academic performance and verifying the utility of the model used for the purpose of explicating the issue of e-learning performance of contemporary students. Data were acquired from a total of 19 members of the experimental group and 24 members of the control group.

Result analysis and interpretation

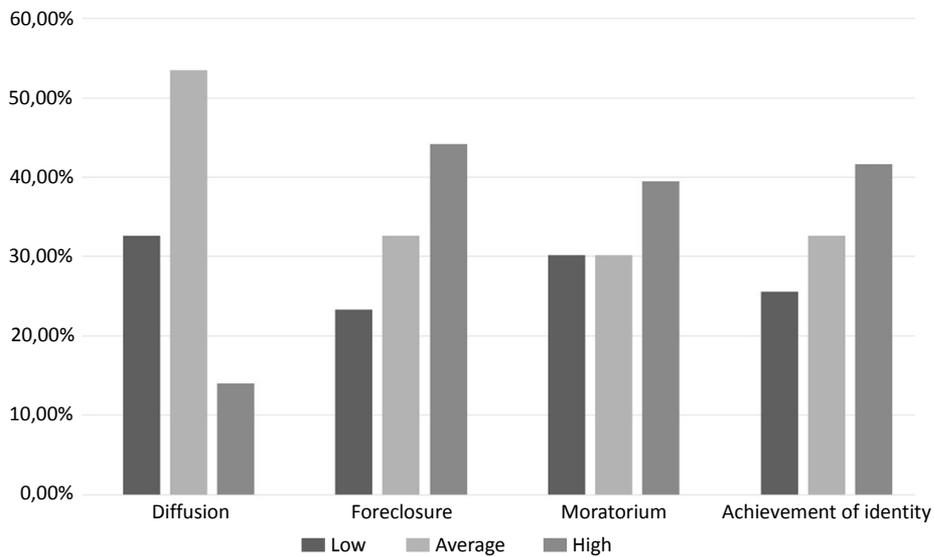
The distribution of the results achieved by the participants according to their personality status indicates that the highest scores were achieved primarily by participants in the foreclosure stage (44.2%). These were followed by achievement (41.6%), moratorium

Table 1. Percentage distribution of identity status in the education student sample

	Diffusion	Foreclosure	Moratorium	Achievement
Low	32.6%	23.3%	30.2%	25.6%
Average	53.5%	32.6%	30.2%	32.6%
High	14.0%	44.2%	39.5%	41.6%

Source: author's own work.

Figure 1. Percentage distribution of identity status in the teaching student sample



Source: author's own work.

(39.5%) and diffusion (14%). The majority of the participants were at the foreclosure stage, i.e. they did not experience an identity crisis and did not take actions of their own, but were instead involved in the various activities expected of them by an authority figure. A surprisingly high percentage of the participants were at the achievement stage, i.e. they were ready to choose and make decisions of their own based on their own explorations.

These four human identity statuses can impact how an individual enters adulthood and may influence how early adulthood activities are conducted (Brzezińska, 2017). This may in turn determine academic performance when using different teaching methods (in-class vs. online).

In order to answer another research question, whether there is a relation between the identity status of students and their academic performance using in-class and e-learning methods, a basic descriptive statistics analysis was conducted in addition to Shapiro-Wilk tests and a single-factor mixed analysis of variance. The classic threshold of $\alpha = 0.05$ was used as the significance level, though probability values where p was greater than 0.05 and less than 0.1 were interpreted as significant at the statistical trend level.

Basic descriptive statistics of the quantitative variables measured

The basic descriptive statistics were calculated for the results of the repeated measurements, in addition to a Shapiro-Wilk test of normality. One of the assumptions behind using the mixed method was that the distribution of the variables did not deviate significantly from a normal distribution. The results of the test indicated that the distribution of the results of tests 1, 2 and 4 matched the criteria of a normal distribution, with only test 3 differing in this regard. Certain doubts may arise as to the normality of the results of the latter test, as their value was 0.045, i.e. lower than 0.05. In this case, however, it was important to take into account the skewness value, which was -0.76. If its absolute value does not exceed 2, the distribution can be accepted as close to normal (George and Mallery, 2010). The relevant measurement matched the above criterion. It can thus be assumed that the distributions studied were not significantly asymmetrical with regard to the mean. Therefore, for the purpose of analyzing the results of the study, parametric tests were conducted which matched their remaining criteria. The results are presented in Table 2.

Table 2. Basic descriptive statistics for the results of each test

	<i>M</i>	<i>Me</i>	<i>SD</i>	<i>Sk.</i>	<i>Curt.</i>	<i>Min.</i>	<i>Max.</i>	<i>S-W</i>	<i>p</i>
Test 1	61.91%	63.79%	0.17	0.01	-0.32	24%	98%	0.993	0.997
Test 2	61.85%	63.54%	0.25	-0.58	-0.24	0%	100%	0.952	0.073
Test 3	71.33%	72.11%	0.14	-0.76	0.43	30%	92%	0.947	0.045
Test 4	71.31%	72.20%	0.11	-0.02	0.05	48%	95%	0.973	0.401

M – mean; *Me* – median; *SD* – standard deviation; *Sk.* – skewness; *Curt.* – curtosis; *Min.* and *Max.* – lowest and highest value in the distribution; *S-W* – Shapiro-Wilk test result; *p* – significance

Source: author's own work.

The Identity of Young Adults and their E-learning Performance

Student test results by learning method and identity

In order to verify the hypothesis that the form of learning (online or in-class) is related to the academic performance of students within the context of their identity, a 4 x 4 x 2 analysis of variance was conducted, i.e. the results of each knowledge test were multiplied by the dominant identity type by experimental or control group. This type of analysis was selected due to the way the experiment was designed, i.e. the participants were assigned to one of two groups before the study began and divided according to their dominant identity type, and were then given four knowledge tests. In order to minimize possible discrepancies resulting from any differences in difficulty between the 4 knowledge tests, which could be unrelated to the teaching method or the identity of the participants, standardized values were taken into account in the study, calculated based on the sum of the results of every test.

A statistically significant primary effect of the *group* variable was identified: $F(1; 38) = 22.76; p < 0.001; \omega^2 = 0.37$. Participants in the experimental group performed better ($M = 0.64; SE = 0.17$) than those from the control group ($M = -0.35; SE = 0.17$). No statistically significant main effects were identified for the remaining variables. No effects were observed at the statistical trend level. The above also applies to every first and second-order interaction effect analyzed.

An analysis of the simple effects conducted using the Bonferroni correction indicated that in each of the four measurements the participants who initially (between the first and second test) utilized e-learning before switching (between the third and fourth test) to in-class learning achieved significantly higher results than participants who initially used the in-class method and later switched to e-learning ($p = 0.002$ for test 1, $p = 0.002$ for test 2, $p = 0.035$ for test 3, $p = 0.027$ for test 4). The standardized results of these tests did not vary significantly between the measurements, however, which implies that the variable *test* had no statistically significant primary effect: $F(3; 114) = 0.40; p = 0.751; \omega^2 = 0.01$.

In light of the above, it is thus necessary to assume that the standardized values of the tests results were unrelated to any of the independent variables included in the study, with the exception of being assigned to the experimental or control group.

Thus, an identical analysis was conducted, this time taking into account the raw scores in all 4 tests, without standardization. As the sphericity criteria were not met [Mauchly's $W(5) = 0.47; p < 0.001$], the Greenhouse-Geisser correction of the degrees of freedom was applied. This time, a statistically significant primary effect of the variable *group* was also identified: $F(1; 38) = 27.38; p < 0.001; \omega^2 = 0.42$. A statistically significant first-order interaction was observed for the *test* and *group* variables: $F(2.10; 79.57) = 4.56; p = 0.012; \omega^2 = 0.10$. The remaining primary and interaction effects were not statistically significant.

A simple effects analysis demonstrated that for the control group the results from test 1 ($M = 55.7\%, SE = 0.04$) were significantly lower than the results from test 4 ($M = 67.5\%, SE = 0.03$). No statistically significant differences were observed in the experimental group between the results of individual tests. On the other hand, in the experimental group, the results of every test were significantly higher than in the control group ($p = 0.002$ for test 1, $p = 0.002$ for test 2, $p = 0.035$ for test 3, $p = 0.027$ for test 4). The results are presented in Table 3 and Figure 2.

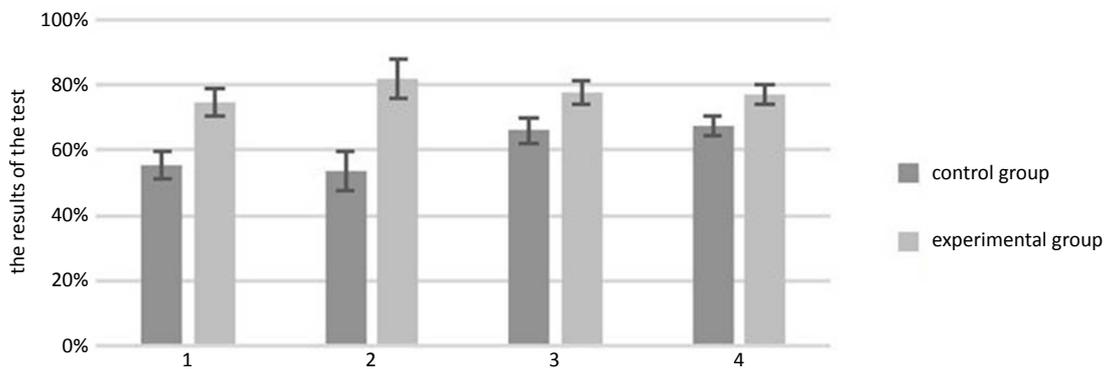
It is worth noting that the raw results of the tests were related to being a member of the experimental or control group, but not with the dominant identity type, and did not vary significantly between the four individual measurements taken, with the exception of higher results for test 4 in the control group compared to the results for test 1.

In summation, it is important to note that the study demonstrates the state of identity statuses at the point in time the study was conducted – i.e. when the test was taken. Brzezińska notes that “personality is at no point in life something set and ‘complete’, it continues to change, is constantly rebuilt and modified under the influence of new experiences. This means that there

Table 3. Summary of the results of the four tests conducted in the control and experimental groups

				95% CI	
		<i>M</i>	<i>SE</i>	<i>LL</i>	<i>UL</i>
Control group	1	55.7%	0.04	47.4%	63.9%
	2	53.9%	0.06	42.0%	65.7%
	3	66.0%	0.04	58.4%	73.6%
	4	67.5%	0.03	61.5%	73.5%
Experimental group	1	74.6%	0.04	66.2%	83.0%
	2	82.1%	0.06	70.0%	94.1%
	3	77.8%	0.04	70.0%	85.6%
	4	77.2%	0.03	71.1%	83.3%

M – mean; *SE* – standard error; 95% *CI* – confidence interval between means; *LL* and *UL* – lower and upper confidence interval limits
Source: author's own work.

Figure 2. Comparison of the control and experimental group with regard to the results of each test

Source: author's own work.

is great research potential with regard to the process of how personality is formed during early adulthood and later, as well as its relations with objective and subjective adulthood indicators” (2017, p. 55). The above points to an area which is difficult to study, as personality is never constant and continues to change in various contexts. Marcia's model has been further developed and modified by other researchers to include new dimensions of human identity development based on empirical research (Brzezińska, 2017, p. 62), which is worth incorporating into subsequent studies.

Conclusions

The results of the pilot study reveal that the participants in the experimental group achieved higher results, as evidenced by their scores in test 1, where the experimental factor was introduced immediately before. Subsequent tests results were similar in that the difference in favor of students utilizing e-learning methods was markedly greater. Unfortunately, no relation was identified with the identity of learners or interactions between these factors. The only observable differences related to academic performance and the form of learning, and persisted throughout all four tests. The average results for the experimental group were between 74.6% and 82.1%, and between 53.9% and 67.5% in the control group. It is interesting to note that the control group improved to a statistically significant degree between the first and the fourth measurement. The experimental group, on the other hand, displayed similar performance across all tests. The differences between individual measurements in the experimental group were not statistically significant (see Table 3. *Summary of the results of each of the four tests conducted in the control and experimental groups*). The identity of learners does not determine their academic performance. The significant statistical differences only applied to the form of learning, favoring those using e-learning methods. These differences persisted across all tests.

The results of the pilot study demonstrate the necessity to research further issues related to the topic.

It is certainly worth repeating the empirical analyses on a much larger and more diverse sample, which would enable the results to be extrapolated into the entire population. Subsequent studies should identify the relation between the identity status of students and their chosen study program and form of learning. It may be of utility to identify age and gender differences between study participants, which would enable new study results to be published. This research may help fill a niche in both global and domestic literature on the subject, and contribute to identifying new areas for analysis and developing e-learning theories.

References

- Brzezińska, A. (2000). *Spoleczna psychologia rozwoju*. Warszawa: Wydawnictwo Naukowe „Scholar”.
- Brzezińska A. (2003). Stałość i zmiana jako konteksty rozwoju człowieka: o współzależności kontekstu, stylu życia i struktury Ja. In R. Derbis (Ed.), *Niepokoje i nadzieje współczesnego człowieka. Człowiek w sytuacji przełomu* (pp. 14–30). Częstochowa: Wyższa Szkoła Pedagogiczna w Częstochowie.
- Brzezińska, A. (2017). *Tożsamość u progu dorosłości. Wizerunek uczniów szkół ponadgimnazjalnych*. Poznań: Wydawnictwo Naukowe Wydziału Nauk Społecznych Uniwersytetu im. Adama Mickiewicza w Poznaniu.
- Cuprjak, M. (2007). *Tożsamość a rola nauczyciela w okresie wczesnej dorosłości*. Toruń: Uniwersytet Mikołaja Kopernika.
- Cuprjak, M. (2013). Tożsamość w kontekście transformacji. Raport z badań. *Przegląd badań edukacyjnych*, 2(17), 211–225.
- Foucault, M. (2005). Inne przestrzenie. *Teksty drugie*, 6, 117–125. Retrieved from <https://www.ceeol.com/search/article-detail?id=3667>
- George, D., Mallery, P. (Eds.) (2010). *SPSS for Windows Step by Step: A Simple Guide and Reference*. Boston: Pearson.
- Kerr, M.S., Rynearson, K., Kerr, M.C. (2006). Student characteristics for online learning success. *Internet and Higher Education*, 9, 91–105. DOI: 10.1016/j.iheduc.2006.03.002
- Marcia, J.E. (2002). Identity and psychosocial development in adulthood. *Identity. An International Journal of Theory and Research*, 2(1), 7–28. DOI: 10.1207/S1532706XID0201_02

The Identity of Young Adults and their E-learning Performance

Moore, M.G. (1993). Theory of transactional distance. In D. Keegan (Ed.), *Theoretical principles of distance education* (pp. 22–38). London: Routledge.

Moore, M.G. (2007). The theory of transactional Distance. In M.G. Moore (Ed.), *Handbook of Distance Education* (pp. 89–105). New Jersey: Lawrence Erlbaum Associates.

Niemierko, B. (1999). *Pomiar wyników kształcenia*. Warszawa: WSiP.

Rovai, A.P. (2004). A constructivist Approach to Online College Learning. *Internet and Higher Education*, 7(2), 79–93. DOI: <https://doi.org/10.1016/j.iheduc.2003.10.002>

Saba, F. (2003). Distance Education Theory, Methodology, and Epistemology: A Pragmatic Paradigm. In M.G.

Moore, & W.G. Anderson (Eds.) *Handbook of distance education* (pp. 3–20). New Jersey, London: Lawrence Erlbaum Associates Publishers.

Schlosser, Ch.A., & Anderson, M.L. (1994). *Distance Education: Review of the Literature*. Washington, DC: Department of Education. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.934.7231&rep=rep1&type=pdf>

Wróblewska M. (2011). Kształtowanie tożsamości w perspektywie rozwojowej i edukacyjnej. *Pogranicze. Studia Społeczne*, t. XVII, 176–187. Retrieved from https://repozytorium.uwb.edu.pl/jspui/bitstream/11320/867/1/Pogranicze_17.2_Wroblewska.pdf

Abstract

Utilizing Marcia's theory, a pilot study was conducted to determine the relation between the identity status of students and their performance using differing teaching methods (in-class and e-learning). The sample consisted of teaching students, and the main criterion was the use of e-learning. The Identity Status Test and standardized knowledge tests were used to collect data. No relation was identified between the identity status of students and their in-class and e-learning performance. However, the group utilizing e-learning achieved better results compared to the in-class group. Determining the importance of an e-learner's identity is also necessitated by the need to develop appropriate counselling strategies. The analyses rendered possible a preliminary verification of the utility of the concept for the purpose of explicating the issue of the e-learning performance of contemporary students. The conclusions drawn from the study may also offer utility for adapting mentoring processes to the needs of learners. The author identifies and underlines the need for further, more comprehensive empirical research on the identity of e-learners within the context of their study program, age and gender.

Keywords: identity, learning, e-learning, young adult, learning outcomes

Wioletta Kwiatkowska is a teaching graduate from the Nicolaus Copernicus University, an adjunct at the Chair of Teaching and Media in Education of the Faculty of Education of the Nicolaus Copernicus University and a researcher with more than ten years' experience teaching online education methods. Her research and teaching interests focus on online education, in particular the challenges, needs and experiences of learners and teachers in online classrooms, designing e-learning courses and the quality of online education. She is the author of numerous published research articles on these topics and has participated in international and local research and teaching projects related to applying modern information technologies in education. She is also a member of the Association of Academic E-learning, Polish Pedagogical Association and the Polish Cognitive Science Association.

Modern online learning habits

Research shows us that employees are accessing the learning they need differently from how they did just a few years ago. Most are now looking for what they need away from their organisation's Learning & Development channels.

For example, it's recognized that more than 70% of employees will now use web searches to learn what they need for their jobs and are increasingly turning to their mobile devices to find just-in-time, immediate answers to their unexpected problems.

The way people are interacting with their mobile devices provides further insight into modern habits.



91% of smartphone users will turn to their devices for ideas while completing a task!

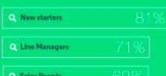


Searches related to "how to" on YouTube are growing 70% each year!



More than 70% of employees use search engines to learn what they need for their jobs; will unlock their smartphones 9 times an hour, and search videos for no longer than 4 minutes!

Employee groups web-searching to learn what they need for their jobs



The Empowered Learner

WE RECOMMEND

The Empowered Learner

The white paper by Looop, commentary provided by David James

By capitalizing on recent insights into today's learners – their motivations, habits and preferences – L&D can drive improved business performance through increased learner engagement.

Research shows us that employees are accessing the learning they need differently from how they did just a few years ago. It is recognized, for instance, that more than 70% of employees will now use web searches to learn what they need for their jobs and are increasingly turning to their mobile devices to find just-in-time, immediate answers to their unexpected problems.

This White Paper reflects and interprets research and insights that have been published by various industry sources and experts in recent years.

More information at <https://www.looop.co/wp-content/uploads/2015/09/The-Empowered-Learner-White-Paper.pdf>

Using Instructional Media to Improve Student Learning Outcomes in an Online Toxicology Course – a Case Study



Egbe Egiebor*



Oluwakayode Adebowale**



Tian-Lih (Ted) Teng***

Over three million students are currently enrolled in fully online programs, and over six million are taking at least one course online as part of their online degree (Allen & Seaman, 2017). This proliferation of online education as an alternative to traditional classroom education makes salient the need for online instructors to continually improve student learning outcomes in online courses. For example, Weiser and Wilson (1999) noted that the development time/cost for online learning media can be up to five times more than the time/cost for traditional lectures.

One of the major setbacks of online teaching is the challenging nature of student engagement and faculty-student interactions (Clark, 2009). Students are more likely to lose interest in online classes than in traditional classroom learning environments (Ward & Newlands, 1998; Sanders, 2006). Making online classes more interactive and captivating may help improve student engagement, which may lead to higher learning outcomes.

Introduction

Various combinations of text, graphics, audio, video and animations can be integrated into online courses. Media selection is very important because of the cost of developing different online instructional media (Sun & Cheng, 2007). Studies show that students' recall of information is higher when content is delivered with visual media. Abstract, new, and novel concepts are learned more easily when they are presented in both verbal and visual forms (Salomon, 1979). Empirical research indicates that visual media make concepts more accessible to people than text media and help with later recall (Cowen, 1984). Visual media may help students retain concepts and ideas. In online learning environments, learners and instructors are often separated by geographic and temporal distance, which trigger transactional distance (Moore, 1993). To mitigate such perceived distance, there must be a high degree of media richness (Mehrabian, 1969, 1981) to bridge this "distance," and achieve greater interactions in online

environments. Therefore, students in online courses with greater media richness will experience lower transactional distance (Ekwunife-Orakwue & Teng, 2014; Adebowale, 2017).

The goal of this case study was to determine how different instructional media impacted student outcomes in an online toxicology course. Student outcomes were operationalized as engagements with course contents based on the PATHs Framework, and grades on assessments.

Stakeholders often struggle to find an operational definition for online learning environments. For the purpose of this study, we used the operational definition of online learning by Allen and Seaman (2010), as shown in Table 1.

Table 1. Operational Definitions of Course Classifications Based on Mode of Content Delivery

Type of Course	Typical Description	Proportion of Content Delivered Online
Traditional Face-to-Face (TF2F)	No online technology is used and content delivery is via writing or orally.	0%
Web Facilitated	A traditional F2F course supplemented/augmented with a web-based technology such as a Content Management System (CMS), or assignment- or syllabus-related web pages.	1–29%
Blended/Hybrid	A hybrid of online and traditional F2F delivery; with more online meetings than F2F meetings.	30–79%
Online	Most or all of the course and its content is delivered online, with no/negligible F2F meetings.	80+%

Source: Allen and Seaman (2010, p. 5) based on a survey of 2,500 Colleges and Universities.

* University of Illinois Springfield, USA

** Blended Learning and Study Center, USA

*** Stony Brook University, USA

The PATHs Framework Approach to measuring engagements with instructional media

The PATHs Framework (Adebowale, 2017) was used to measure the level of engagement of students with each instructional media. As shown in Table 2, student engagement can be measured by Posts, Access, Time, and Hits (PATHs) from learning analytics data stored in the course reports of Learning Management Systems (LMS). Blackboard Learn, the LMS used in this online course, generated nine course reports. Five of these reports were used as a measure of learning analytics for this course. They included user activity inside content areas, course activity overview (CAO), overall summary of user activity (OSUA), student overview for single course (SOSC), and user activity in forums (UAIF). These course reports contained both student-level data and course-level data. Based on the PATHs Framework, the learning analytics data generated from LMS course reports is a good measure of various learner interactions in an online environment, and can be summarized as comprising posts, hits, access, and time spent on content – together referred to as PATHs (Posts, Access, Time, and Hits).

Blackboard Learn LMS generates nine course reports for each course:

1. All User Activity inside Content Areas (UAICA): displays a summary of all user activity inside the Content Areas for the course.
2. Course Activity Overview (CAO): displays overall activity within a single course, sorted by student and date. Data includes the total and average time spent per active student and the total amount and type of activity each student had in the course. Optionally, you can filter the report by one or more groups.
3. Course Coverage Report (CCR): displays goals coverage information for a single Blackboard Learn course. The data includes both covered and gap values for all curricular areas with which the course is associated, as well as a breakdown of course items that have been aligned to goals.
4. Course Performance (CP): displays information showing how a single Blackboard Learn Course performs against a selected set of goals. Performance targets and the range of acceptable performances for the course can be determined when running the report. The data includes averages for the entire course as well as breakdowns for individual students and goals.
5. Overall Summary of User Activity (OSUA): displays user activity for all areas of the course, as well as activity dates, times and days of the week.
6. Single Course User Participation (SCUP): displays detailed statistics on assessment and collaboration tool submissions for all users in this course during a specified timeframe.
7. Student Overview for Single Course (SOSC): displays an individual student's activity within a course, sorted by date. The data includes

Table 2. PATHs Framework for Learning Analytics in Online and Blended Learning Environments (Abridged Version)

PATHs Categories	Learning Analytics Data from LMS
POSTS	<ol style="list-style-type: none"> 1. Number of Posts on Discussion Board forums (such as LMS posts) 2. Number of posts on other types of forum via other media (for example, social media, blogs, wikis, video, audio (in this case, number of audio contributions), conferencing, chats, and texts) <p><i>Blackboard course report (user activity in forums)</i></p>
ACCESS	<ol style="list-style-type: none"> 1. Total Logins (single user and all users) to LMS or other media used in the course 2. Total Items Accessed in the course 3. Total Logins each day of the week 4. Total Logins each hour of the day <p><i>Blackboard course report (user activity inside content areas and overall summary of user activity)</i></p>
TIME	<ol style="list-style-type: none"> 1. Time spent on each course content 2. Time spent on each course application 3. Time spent viewing recorded lectures or videos 4. Time spent each day of the week 5. Time spent on the course <p><i>Blackboard course report (course activity overview and student overview for a single course)</i></p>
HITS (some LMS course reports provide number of hits as clicks)	<ol style="list-style-type: none"> 1. Frequency of access to each course content 2. Frequency of access to lecture capture and/or archived lectures and/or recorded lectures 3. Frequency of access to each discussion board forum <p><i>All Blackboard course reports</i></p>

Source: PATHs Framework (Adebowale, 2017).

the total overall time the student spent in the course as well as detailed information about the student's activity, such as which items and Content Areas the student accessed and the time spent on each.

8. User Activity In Forums (UAIF): displays a summary of user activity in the Discussion Board Forums for the course.
9. User Activity In Groups (UAIG): displays a summary of user activity in the Groups for the course.

Research Questions

- I. What type of instructional media is most successful at helping students understand course concepts as measured by outcomes on assessments?
 - A. Narrated PowerPoint Presentation
 - B. PowerPoint Presentation without narration (PowerPoint slides)
 - C. Online YouTube videos
 - D. Shaky Hand videos
- II. What instructional media leads to the highest level of student engagement based on the PATHS Framework?
- III. What is the relationship between Posts, Access, Time, and Hits (PATHs) in the course and student outcomes on assessments?

Hypothesis

1. Shaky Hand video can help students better understand course concepts than the other forms of instructional media used in the course. Therefore, student outcomes will be higher for concepts taught with Shaky Hand video than concepts taught with other types of instructional media. This is because of its high degrees of media richness, rich visual media, and the perceived feeling of "closeness" that users experience. The second highest student outcomes will be observed for Narrated PowerPoints, then YouTube videos, and finally PowerPoint slides. This sequence is conjectured since students may relate better with media featuring the voice of a familiar instructor (such as Shaky Hand video and Narrated PowerPoint) compared to text-rich media with nonverbal communication such as PowerPoint slides.
2. YouTube and Shaky Hand videos would have the highest number of student engagement because of their high degree of media richness and visual media. Therefore, higher PATHs will be observed for YouTube and Shaky Hand videos compared to other instructional media.
3. There will be a direct and positive relationship between PATHs and student outcomes on assessments.

Study Context

Description of the Environmental Toxicology Online Course

The Environmental Toxicology course used in this study was offered through Blackboard Learn LMS. Students learn about the effects of chemical and physical agents on the health of the public and environment. They particularly study the transport of pollutants, chemical behavior, and biochemical mechanisms of the adverse health effects from environmental pollutants. Different instructional media were incorporated into the online course and were available for students to access throughout the semester. The instructional media included Narrated PowerPoint, PowerPoint slides, Shaky Hand videos and YouTube videos. Statistical tracking was enabled and used to generate the Blackboard Learn course reports at the end of the semester.

Participants

The data for this study was obtained from graduate students enrolled in an online environmental toxicology class in the fall of 2018. The course originated from the public health program at the University of Illinois, Springfield, and its duration was 15 weeks. The sample population comprised 15 students (60% female and 40% male students).

Course assessment

The students enrolled in the Environmental Toxicology course were assessed in a variety of ways, including quizzes, exams, discussion board posts, and term papers. The assessments can be categorized into two types: formative and summative.

Formative assessment:

1. Quizzes: at the end of each week, a timed, open-book quiz (comprising multiple choice and true/false questions) on the week's lecture and textbook contents was assigned on Blackboard Learn LMS. The aggregated grade from all quizzes was worth 30% of the final grade.
2. Discussion board posts: participation was mandatory and "active," which is defined as "providing meaningful expression and well thought out answers to the discussion questions." Meaningful dialogue is participation where the posts answer the discussion question, response to posts from other students, and contribution to group discussions. This was worth 20% of the final grade.

Summative assessments:

1. Exams: Two open-book exams were administered during the course of the semester. The first exam was comprehensive and comprised all the concepts that were taught before the midpoint of the semester. The second exam comprised all the concepts covered throughout the entire semester. Each exam was worth 15% of the final grade, with both exams worth 30% of the final grade.
2. Final paper: the students were asked to select and write about a problem topic that was relevant to toxicology. Problem topics that

Using Instructional Media to Improve Student Learning...

were deemed relevant were preapproved by the instructor. The students were required to relate a historical perspective of the problem or issue, discuss how the problem or issue was recognized, identify the impact of the problem or issue on public or environmental health, explain how the problem or issue is being studied, and outline how the problem or issue is being addressed or controlled. The final paper was worth 20% of the final grade.

Course materials were posted weekly on Blackboard and the students were required to complete their weekly assignments by a specific date at the end of the week. Course reports were run at the end of the semester. Though nine course reports were generated, no data were generated for course coverage and course performance reports, since no course set goals or goal type were included in the course. All subjects completed an informed consent to participate in the study. No incentive was provided for subject participation.

Results and Discussion

As described in the PATHs Framework, learning analytics data from the course reports can be categorized into course-level and student-level data. The data in this study only reflects course-level data.

The maximum number of points that students could earn for each exam was 20. The weighted value of each exam to the final grade was 15%. Each quiz was worth a maximum of 10 points and contributed 20% to the final grade. As shown above, pre-quiz hits were hits observed before the due date of the quiz. Post-quiz hits were hits observed after the due date of the quiz. Week 1 was not included because it was an introductory week and was not graded. Week 13 was

not included because it was the week for completing projects. Hits were not observed for Weeks 2 through Week 5 because data from Blackboard Learn LMS were purged from the server due to the 180 day limitation. The hits were collated weekly, and though some weeks covered two or three PowerPoint chapters, hits on all chapters counted as one hit and not two or three separate hits. Based on the data above, student hits were higher for Week 10 Narrated PowerPoint (107 hits) compared to any other form of instructional media. Week 10 also had the third highest post-quiz hits, but the second lowest average grade on quiz assessments (8.48 points). The Week 11 Narrated PowerPoint had the fourth highest pre-quiz hits (70 hits), the second highest post-quiz hits (81 hits), and the highest average grade on quiz assessments (9.62 points). Overall, students performed better on quiz assessments for which Narrated PowerPoint was used for instructional delivery compared to other forms of media.

The Total Number of Weekly Hits on Course Content was used to measure student engagement with the instructional media. As shown above, there was no direct correlation between the type of instructional media and weekly hits on course contents (Figure 2), since the overall trend was a decrease in hits through the semester (from 1400 hits in week 2 to 590 hits in week 15) (Figure 1). This is consistent with previous findings described in Adebowale (2017), which showed that student engagement level, as measured by the number of hits, often declines as the semester progresses. Strategies are needed to sustain the same student-engagement levels that are observed in the first half of the semester (Table 4). An important observation is the low level of hits based on PowerPoint instructional media compared to the other forms of media.

Table 3. Student engagement with instructional media (as measured by the number of pre- and post-quiz hits) (H)

Week	Instructional media	Number of pre-quiz hits	Average Grade on Quiz Assessment	Number of post-quiz hits
2	Chapter 1 Narrated PowerPoint	–	9.00	35
3	Chapter 2 YouTube video (Bhopal gas tragedy)	–	8.26	33
4	Chapters 3/4 PowerPoint slides	–	9.06	39
5	Chapters 5/6 Shaky Hand video (Dose response)	–	9.28	49
6	Chapters 7/8 PowerPoint slides	–	9.25	56
7	Chapter 9 PowerPoint slides	52	9.50	50
8	Chapter 10 PowerPoint slides	84	9.00	37
	Exam 1	–		
9	Chapter 11 PowerPoint slides	65	9.00	36
10	Chapters 12/13/14 Narrated PowerPoint	107	8.48	68
11	Chapters 15/16/17 Narrated PowerPoint	70	9.62	81
12	Chapter 19 PowerPoint slides	63	9.40	97
14	Chapter 24 PowerPoint slides	73	8.53	50
15	Chapter 25 PowerPoint slides	–		
	Exam 2	–		

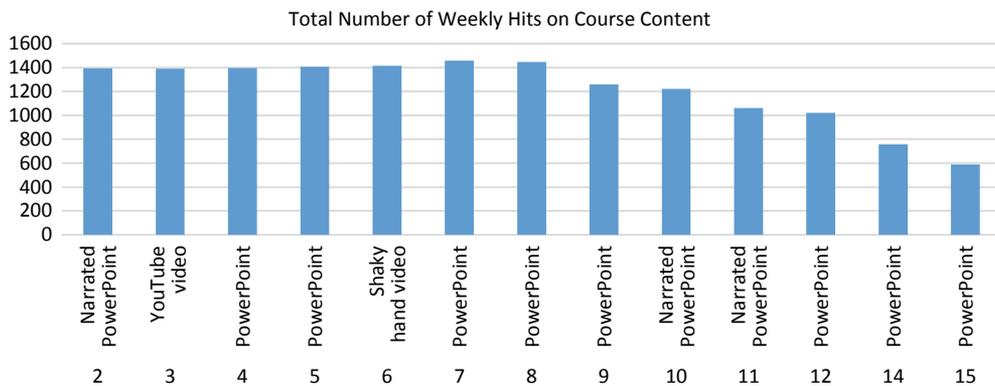
Source: LMS Course Reports on Hits on Instructional Media.

Table 4. Student engagement with instructional media (as measured by the number of weekly hits (H) on course contents)

Week	Type of Instructional media	Total Number of Weekly Hits on Course Content	Average Grade on Quiz Assessment
2	Narrated PowerPoint	1393	9.00
3	YouTube video	1391	8.26
4	PowerPoint slides	1397	9.06
5	Shaky Hand video (Dose response)	1407	9.28
6	PowerPoint slides	1414	9.25
7	PowerPoint slides	1459	9.50
8	PowerPoint slides	1447	9.00
Exam 1			
9	PowerPoint slides	1260	9.00
10	Narrated PowerPoint	1221	8.48
11	Narrated PowerPoint	1062	9.62
12	PowerPoint slides	1022	9.40
14	PowerPoint slides	757	8.53
15	PowerPoint slides	590	
Exam 2			

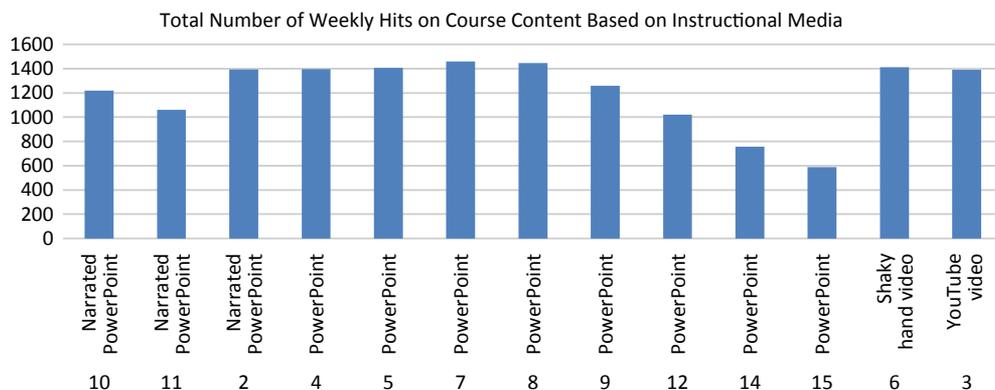
Source: authors' own study.

Figure 1. Total Course Hits on Contents per Week



Source: LMS Course Reports User Activity Inside Content Areas.

Figure 2. Total Number of Weekly Hits Aggregated by Type of Instructional Media



Source: LMS Course Reports User Activity Inside Content Areas.

Using Instructional Media to Improve Student Learning...

Table 5. Student engagement with instructional media (as measured by the number of weekly hits (H) and posts (P) on discussion board forums)

Week	Type of Instructional media	Total Number of Weekly Hits on discussion board forum	Total number of weekly posts on discussion board forum	Average Grade on Quiz Assessment
2	Narrated PowerPoint	190	21	9.00
3	YouTube video	296	26	8.26
4	PowerPoint slides	–	–	9.06
5	Shaky Hand video (Dose response)	267	34	9.28
6	PowerPoint slides	–	–	9.25
7	PowerPoint slides	222	34	9.50
8	PowerPoint slides	–	–	9.00
Exam 1				
9	PowerPoint slides	–	–	9.00
10	Narrated PowerPoint	–	–	8.48
11	Narrated PowerPoint	–	–	9.62
12	PowerPoint slides	–	–	9.40
14	PowerPoint slides	757	–	8.53
15	PowerPoint slides	590	–	–
Exam 2				

Source: authors' own study.

If student engagements are higher with media-rich instructional media such as Shaky Hand video and Narrated PowerPoint, then higher numbers of hits and posts should be expected during the weeks in which these media were used for instructional delivery. As shown above, prior to Exam 1, the discussion board forum with YouTube video had the highest number of hits (296 hits), followed by the forum with Shaky Hand

video (267 hits), and then the forums with PowerPoint slides and Narrated PowerPoint with 222 hits and 190 hits respectively. This may be an affirmation of the media richness theory (Mehrabian and Ferris, 1967), which states that videos have higher media richness than media with nonverbal communications. Overall, this hypothesis of the current study was supported by this observation. The symbol “-” indicates the discus-

Table 6. Student engagement with instructional media (as measured by the time spent (T) on instructional media and the frequency of access (A))

Week	Type of Instructional media	Total time (T) spent on media in hours	Number of times Instructional Media was Accessed (A)	Average Grade on Quiz Assessment
2	Narrated PowerPoint	0	36	9.00
3	YouTube video	0	39	8.26
4	PowerPoint slides	0	68	9.06
5	Shaky Hand video (Dose response)	0.01	79	9.28
6	PowerPoint slides	0	59	9.250
7	PowerPoint slides	0	34	9.500
8	PowerPoint slides	0	24	9.00
9	PowerPoint slides	0	27	9.00
10	Narrated PowerPoint	0	74	8.48
11	Narrated PowerPoint	0.05	68	9.62
12	PowerPoint slides	0	40	9.4
14	PowerPoint slides	1.4	28	
15	PowerPoint slides	0	27	

Source: LMS Course Report Single Course Activity Overview (SCAO).

sion board forum was not part of the week’s activities. The high level of hits observed during weeks 14 and 15 may be due to students reviewing course contents for the final exam.

Partial data was obtained for time spent on each media. This may be due to the course report not capturing time spent below a certain threshold. The frequency of access (A) to each media showed higher access to Narrated PowerPoint (average Access = 59.33) and Shaky Hand video (Access = 79) compared to YouTube video (Access = 39) and PowerPoint slides (average Access = 38.38), which had the least access. Additionally, analytics on Access and Time for each media were not provided by running a course report of each media. Rather, they were obtained from the Single Course Activity Overview (SCAO) report. In some SCAO reports, analytics for Narrated PowerPoint and YouTube videos were not generated among other data; as a result, Access and Time were obtained from the content folder analytics.

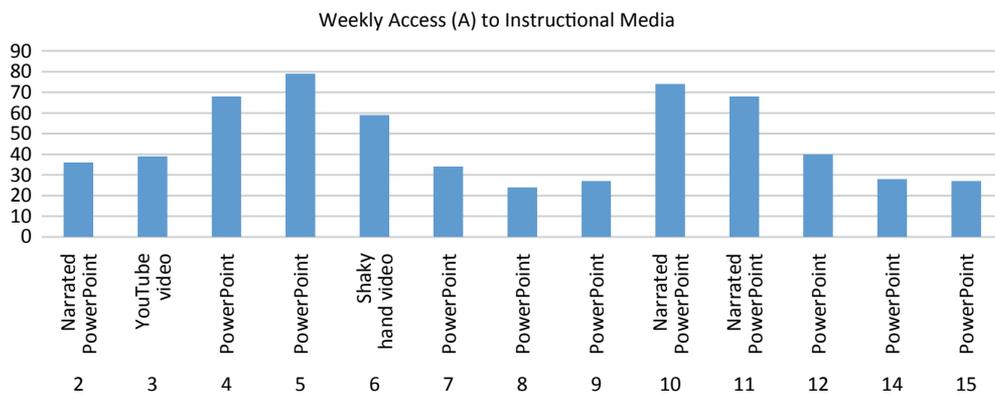
As shown in the Figure 3, there was no defined relationship between access to instructional media and the weeks. Unlike posts (P) and Hits (H) on weekly contents, which peaked during the first half of the semester and continuously declined for the rest of the semester, access (A) to instructional media showed no

specific correlation with the weeks of the semester. A notable observation was the sudden increase in Access in Weeks 10 and 11, when Narrated PowerPoint was used, and the rapid decrease afterwards in Week 12 when PowerPoint slides were used. A limitation to this observation was the limited sample size used in this study, which make it difficult to compare the weekly contents; and hence its generalizability.

As shown in Figure 4, when the weeks of the semester were ordered based on the type of instructional media used, a pattern that emerged clearly showed that the average access (A) was the best approach to explaining the differences between the types of access to each form of instructional media.

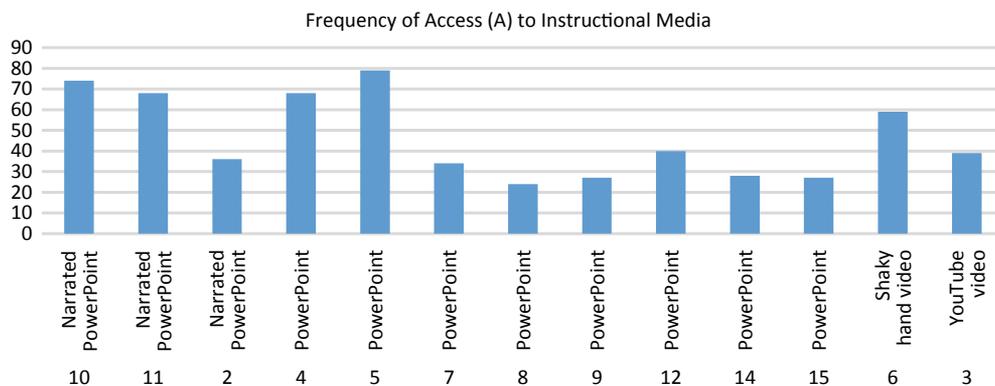
Quiz Assessments were based on open-book questions, and were available at the beginning of the week. Quizzes were given weekly. Each quiz had a force-completion requirement, i.e. the student must complete the quiz once it is deliberately opened. Each graded quiz assessment remained open for students to access and review during the course. Students with high PATHs on the instructional media were expected to spend less time on each weekly quiz assessment, since they should have mastered the concepts. In addition, students were expected to spend less time on quizzes that were based on content delivered with

Figure 3. Total Access (A) to Instructional Media Organized by Weeks



Source: LMS Course Report Single Course Activity Overview (SCAO).

Figure 4. Overall Access (A) to Instructional Media



Source: LMS Course Report Single Course Activity Overview (SCAO).

Using Instructional Media to Improve Student Learning...

instructional media high in media richness compared to other forms of media. Table 7 shows the course-level data of total time spent on each quiz assessment by all students on the course.

As shown in Figure 5, the students spent less time (on average) on quiz assessments in which Narrated PowerPoint was used to deliver instruction compared to other forms of instructional media. YouTube video and Shaky Hand video had the next least times respectively. Quiz assessments in which PowerPoint slides were used to deliver instruction showed the highest time spent by students. Limitations to this observation include difficulty of the quiz, the number of chapters covered in the quiz, limited sample size, and other learner factors that could have contributed to the variance in performance.

As previously stated, Quiz Assessments were available at the beginning of each corresponding week. Students were only allowed to attempt the quizzes in one sitting; however, each graded quiz assessment remained open for students to access and review dur-

ing the course of the semester. Since the mid-term and final exams were cumulative, students could access each quiz assessment while taking the exams. Based on the media richness of each instructional media, students were hypothesized to have lower access to quiz assessments on instruction in which instructional media with verbal communications were used (e.g. YouTube video, Shaky Hand video, and Narrated PowerPoint) compared to media with nonverbal communications (e.g. PowerPoint slides). This is based on the conjecture that instructional media with high media richness improves long term memory storage of information compared to media that has low media richness. Hence, students were expected to recall information faster, and therefore spend less time on quiz assessments with instruction based on instructional media with high media richness.

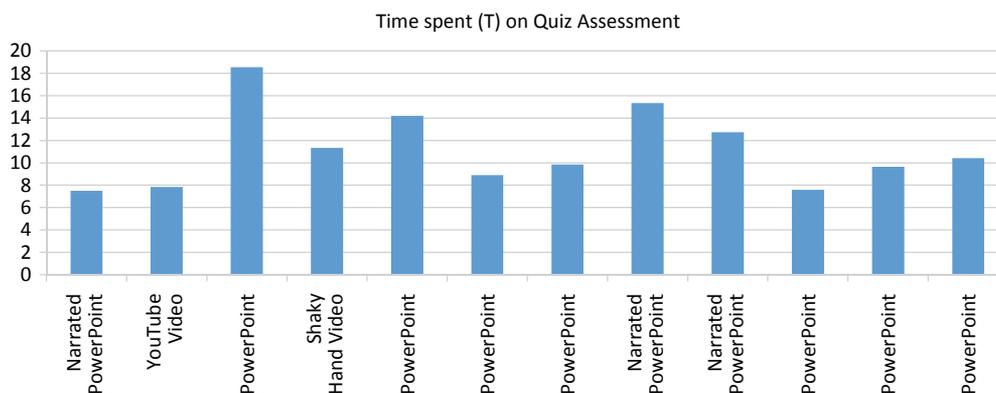
As shown in Figure 6, the students had the lowest access to quiz assessments in which instruction was delivered using YouTube video instructional media compared to other forms of instructional media. This

Table 7. Time Spent on Quiz Assessments

Week	Instructional media	Time (T) spent on Quiz Assessment (in hours)	Average Grade on Quiz Assessment
2	Chapter 1 Narrated PowerPoint	7.50	9.00
3	Chapter 2 YouTube video (Bhopal gas tragedy)	7.84	8.26
4	Chapters 3/4 PowerPoint slide	18.55	9.06
5	Chapters 5/6 Shaky Hand video (Dose response)	11.33	9.28
6	Chapters 7/8 PowerPoint slide	14.18	9.25
7	Chapters 9 PowerPoint slide	8.90	9.50
8 and 9	Chapters 10/11 PowerPoint slide	9.84	9.00
10	Chapters 12/13/14 Narrated PowerPoint	15.33	8.48
11	Chapters 15/16/17 Narrated PowerPoint	12.72	9.62
12	Chapter 19 PowerPoint slide	7.58	9.40
14	Chapter 24 PowerPoint slide	9.63	8.53
15	Chapter 25 PowerPoint slide	10.41	–

Source: LMS Course Report Course Activity Overview (CAO).

Figure 5. Time Spent on Quiz Assessment Based on Type of Instructional Media



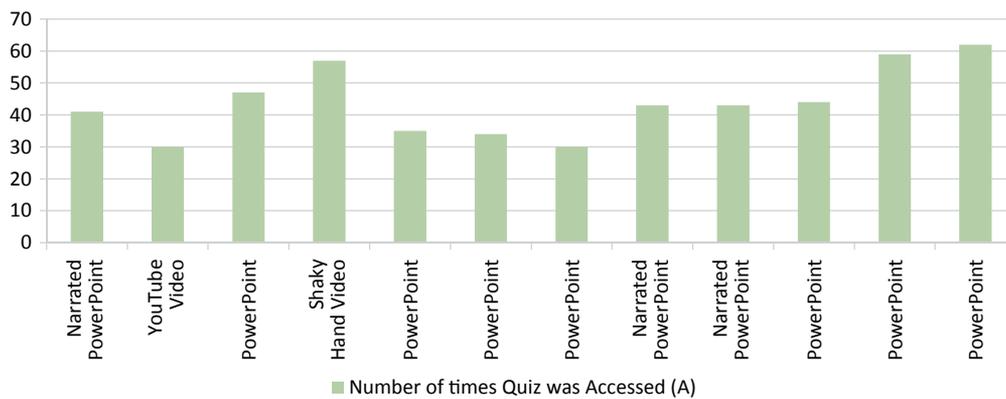
Source: LMS Course Report Course Activity Overview (CAO).

Table 8. Frequency of Access (A) to Quiz Assessments

Week	Instructional media	Number of times Quiz was Accessed (A)	Average Grade on Quiz Assessment
2	Chapter 1 Narrated PowerPoint	41	9.00
3	Chapter 2 YouTube video (Bhopal gas tragedy)	30	8.26
4	Chapters 3/4 PowerPoint slides	47	9.06
5	Chapters 5/6 Shaky Hand video (Dose response)	57	9.28
6	Chapters 7/8 PowerPoint slides	35	9.25
7	Chapter 9 PowerPoint slides	34	9.50
8 and 9	Chapters 10/11 PowerPoint slides	30	9.00
10	Chapters 12/13/14 Narrated PowerPoint	43	8.48
11	Chapters 15/16/17 Narrated PowerPoint	43	9.62
12	Chapter 19 PowerPoint slides	44	9.40
14	Chapter 24 PowerPoint slides	59	8.53
15	Chapter 25 PowerPoint slides	62	

Source: LMS Course Report Course Activity Overview (CAO).

Figure 6. Frequency of Access to Quiz Assessments



Source: LMS Course Report Course Activity Overview (CAO).

may suggest that students recall better when instruction is delivered with YouTube video compared to other media. Instructions delivered with Shaky Hand video and PowerPoint had the highest access to quiz assessments; an indication of lower media richness. Narrated PowerPoint showed lower student access to quiz assessments; an indication that its media richness was higher than Shaky Hand video and PowerPoint.

Conclusions and implications

This study hypothesized that students would have high PATHS on instructional media with higher media richness, and that students were also expected to perform better on weekly quiz assessments based on instructions delivered with media that have higher media richness. Overall, Narrated PowerPoint had the highest PATHS and lowest quiz access, and more importantly the highest scores on assessments. YouTube video had the next highest PATHS, lower quiz access, but lower scores on assessments. Higher PATHS

were observed with Shaky Hand videos compared to PowerPoint. These findings are consistent with both the transactional distance theory and media richness theory. The implication of these findings clearly shows the need for more instructional media with high media richness in online courses; specifically, environmental toxicology courses. Instructional media with high media richness mitigates the transactional distance experienced by learners and instructors in online environments. More importantly, lecture capture, as represented by Narrated PowerPoint media, is an important PATHS factor that influences student outcomes on assessments. This is consistent with the findings in Ekwunife-Orakwue (also known as 'Adebowale') and Teng (2014), which showed courses with lecture capture having the highest PATHS as measured by Learner-Content interaction, and also producing the greatest variance in student satisfaction in online and blended courses. Future studies would have to expand the number of courses used in the study, as well as the sample size of students group.

References

Adebowale, K. (2017). *Learner Analytics Patterns of Online Students' Interactions with Course Contents – Impacts on Student Outcomes, and Usefulness for Predictive Models to Optimize Student Outcomes in Online Courses in Blackboard Learn Learning Management System of Stony Brook University's School of Professional Development* (Unpublished doctoral dissertation). Stony Brook University, Stony Brook, New York.

Allen, I.E., & Seaman, J. (2010). *Learning on Demand: Online Education in the United States, 2009*. Retrieved from Sloan Consortium website: <http://sloanconsortium.org/publications/survey/pdf/learningondemand.pdf>

Allen, I.E., & Seaman, J. (2017). *Digital Learning Compass: Distance Education Enrollment Report*. Retrieved from Babson Survey Research Group website: <https://www.onlinelearningsurvey.com/reports/digitallearningcompassenrollment2017.pdf>

Clark, R.E. (2009). *Past and future research in online education*. (Unpublished paper presented at the 2009 annual meeting of the American Education Research Association), San Diego, CA.

Cowen, P.S. (1984). Film and text: Order effects in recall and social inferences. *Educational Communication and Technology*, 32, 131–144.

Ekwunife-Orakwue (Adebowale), O. & Teng, T. (2014). The impact of transactional distance dialogic interactions on student learning outcomes in online and blended learning environments. *Computers & Education Journal* 78, 414–427.

Mehrabian, A. (1969). Significance of posture and position in the communication of attitude and status relationships. *Psychological Bulletin*, 71(5), 359–372.

Mehrabian, A. (1981). *Silent messages: Implicit communication of emotions and attitudes*. Belmont, CA: Wadsworth.

Mehrabian, A. & Ferris, S.R. (1967). Inference of attitudes from nonverbal communication in two channels. *Journal of Consulting Psychology*, 31(3), 248–252.

Moore, M.G. (1993). Theory of transactional distance. In D. Keegan, (Ed.), *Theoretical principles of distance education*. New York: Routledge.

Salomon, G. (1979). *Interaction of media, cognition, and learning: An exploration of how symbolic forms cultivate mental skills and affect knowledge acquisition*. San Francisco: Jossey-Bass.

Sanders, R. (2006). The “imponderable bloom”: Reconsidering the role of technology in education. *Innovate: Journal of Online Education*, 2(6). Retrieved from <https://nsuworks.nova.edu/innovate/vol2/iss6/6/>

Sun, P.C., & Cheng, H.K. (2007). The design of instructional multimedia in e-learning: A media richness theory-based approach. *Computers and Education*, 49(3), 662–676. DOI: 10.1016/j.compedu.2005.11.016

Ward, M., & Newlands, D. (1998). Use of the Web in undergraduate teaching. *Computers and Education*, 31(2), 171–184. DOI: 10.1016/S0360-1315(98)00024-4

Weiser, M., & Wilson, R.L. (1999). Using video streaming on the Internet for a graduate IT course: A case study. *Journal of Computer Information Systems*, 39(3), 38–43.

Abstract

This case study investigated how student interaction patterns (Moore, 1993) with different instructional media in a graduate level online environmental toxicology course impacted student outcomes, as measured by grades and student engagement levels. Student engagement levels were measured as Posts, Access, Time, and Hits (PATHs) by using the PATHs Framework (Adebowale, 2017) approach to quantify learning analytics obtained from a Learning Management System. Data was obtained from 13 online students during the fall 2018 semester. Findings indicate that Narrated PowerPoint and Shaky Hand video led to higher student outcomes compared to the other forms of instructional media. Implications for course design, quality assurance mechanisms, assessments, improvement of student outcomes, and criteria for selecting the type of instructional media to use in online courses are also discussed.

Keywords: instructional media, PATHs analytics framework, transactional distance, narrated PowerPoint, shaky hand video, YouTube video, student outcomes, assessments, media richness, course design, learning management system, course reports

Egbe Egiebor, PhD is an Assistant Professor in the Department of Public Health at the University of Illinois Springfield. She received a Master's degree in Environmental Science from Tuskegee University in Alabama and a PhD in Toxicology from the University of Maryland.

Oluwakayode (Kayode) Adebowale received his PhD from Stony Brook University, New York. He served as a Visiting Research Assistant Professor in the Department of Educational Leadership at the University of Illinois, Springfield. He also worked at the Center for Online Learning, Research and Service (COLRS). Dr. Adebowale is the Founder and Executive Director of Blended Learning and Study Center.

Tian-Lih (Ted) Teng, PhD is a Research Professor in the Department of Technology and Society at Stony Brook University, New York. Currently, he teaches data science and big data for technological systems management and eCommerce, as well as Technology Assessments.

Playing with Benford's Law



Tomasz
Kopczewski*



Iana
Okhrimenko*

Benford's Law (BL) can be defined as a collection of empirical evidence related to the frequency distribution of the leading digits in numerical data sets. The best-known version of the law states that in those data sets representing a collection of "natural" data, the probability of seeing a particular digit in the first position is inversely related to its rank. For example, 1 appears as the first digit in about 30% of all cases, while 9 appears in less than 5% of cases. Other versions of BL define the frequency distribution of the second digits, third digits, and their combinations. The history of the discovery of this law makes it even more mysterious. Initially explored by Newcomb (Newcomb & Nuw, 1881), the law was forgotten for more than 50 years. Benford (1938) rediscovered it, and used it to explain the behavior of numerous data sets from different domains of science. BL can be treated as one of the most exciting representations of the power laws, which are used in natural sciences and empirical research in economics (Gabaix, 2016).

Introduction

In real-life numbers are assumed to be defined by random events, thus following BL. However, our perception of randomness deviates from true randomness. Falk and Konold (1997) note that the human mind tends to produce rather dense distributions, assuming that the probability of any digit taking first position is equal for all digits. In other words, we expect digits to be uniformly distributed, and the chances of seeing any digit in the first position are equal (with a chance of $\frac{1}{9} \approx \sim 11.1\%$). If the numbers are generated by the human mind, the distribution of the first digits should differ from Benford's distribution. Therefore, BL can be used as a test for whether a dataset contains real-life numbers (Gauvrit et al., 2017). A particular area of BL application is in the fight against tax fraud (Drake & Nigrini, 2000).

The popularity of BL, especially in the accounting textbooks, rises as big data analysis enters everyday

accounting practice (Janvrin & Watson, 2017). However, the application of BL should not be limited solely to these areas; it seems that not only accounting and finance, but other fields of economics can be enriched by introducing BL to the academic curriculum. The present paper utilizes a simple tax fraud classroom experiment based on BL in order to achieve the following teaching goals: i) demonstrating to undergraduate economics students the complexity of probability theory as well as biases related to "folk" probability estimation in the human mind; ii) showing the opportunities for big data analysis; iii) discussing the reliability of publicly available data and ways to check it; iv) familiarizing the students with simple programming tools for simple applied economic problems.

The first part of the paper discusses the history of BL, its functional form, and its application in anti-tax fraud procedures. The second part is devoted to the potential of BL to enrich the academic curriculum of different economics subjects. Finally, the third part presents the detailed guide for the lecture devoted to BL, including classroom experiment methodologies and relevant empirical and theoretical support.

History, formulation, and testing of BL

The history of BL began in 19th century when an astronomer, Newcomb (1881), noticed that the first pages of the logarithm books in the library were the most thumbed, while the last pages left relatively undamaged. He explained this by the fact the frequency of distribution of the first digits is not uniform and is instead inversely dependent on the digit's rank. Initially, this distribution pattern was defined as

$$P_d = \log_{10} \left(1 + \frac{1}{D} \right) \quad (1)$$

where

D is the digit's rank;

P_d is the probability of seeing digit D as the first digit in the randomly chosen number.

* University of Warsaw, Poland

Equation (1) implies that probability P_D of the first digit D occurring, which takes the value from the range $D \in [1..9]$, can be defined as a common logarithm

of $\left(1 + \frac{1}{D}\right)$. If the distribution of the first digit was

uniform, the probability of any specific digit occurring as the first digit would be identical for each digit (approximately 11.1%). However, according to the Newcomb's formula for probability distribution (1), for the digits 1, 2, and 9, the probability of appearing as the first digit is close to 30%, 17%, and 4%, respectively. The pattern is general and irrespective of the unit of measurement or data source, and thus is referred to as a "universal property of real world measurements" (Sambridge & Tkalčić, 2010), or, more poetically, the „harmonic" nature of the world (Furlan, 1948). The law was rediscovered by Benford in 1938, who analyzed 20,229 numbers related to city populations, financial data, etc. from 20 different statistical sources, and proved that the distribution of the first digits followed the pattern he defined.

BL can be extended to other systems besides the decimal. The more general form of BL is presented in equation (2).

$$P_D = \log_B \left(1 + \frac{1}{D} \right) \quad (2)$$

where

D is the digit's rank;

B is the number of digits in the system (for instance, for a binary system, $B = 2$).

It is possible to define the distribution pattern not just for a single digit D , but also for a combination of n digits. Table 1 presents the precise expected frequency of the first four digits in accordance with Benford's distribution. Figure 1 shows the probability

distribution function for the first digit, which is the most commonly applied.

The explicit and unified theoretical justification of BL still has to be developed (Sambridge et al., 2011; Berger & Hill, 2011). Nevertheless, the attempts to design it have resulted in the theorem of random samples from random distributions. This theorem suggests that even if some individual distributions of real data do not follow BL, random samples taken from such distributions still do (Hill, 1995). As discussed in the next section, numerous studies have explored the opportunity to exploit BL for the sake of uncovering tax fraud. From this perspective, the researchers need statistical tools that can provide reliable results concerning the deviations of the hypothetically "natural" data samples from the distributions predicted by BL.

One of the most common methods of testing the consistency of theoretical and empirical distributions is the goodness-of-fit test. The null hypothesis (H_0) states that a sample of the data does not differ from the sample predicted by BL. The test statistics have the typical Chi-squared distribution (Cho & Gaines, 2007, p. 220):

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}$$

where

O_i is the observable frequency of digit i ;

E_i is the expected frequency of digit i (i.e., frequency predicted by BL);

n is the number of observations.

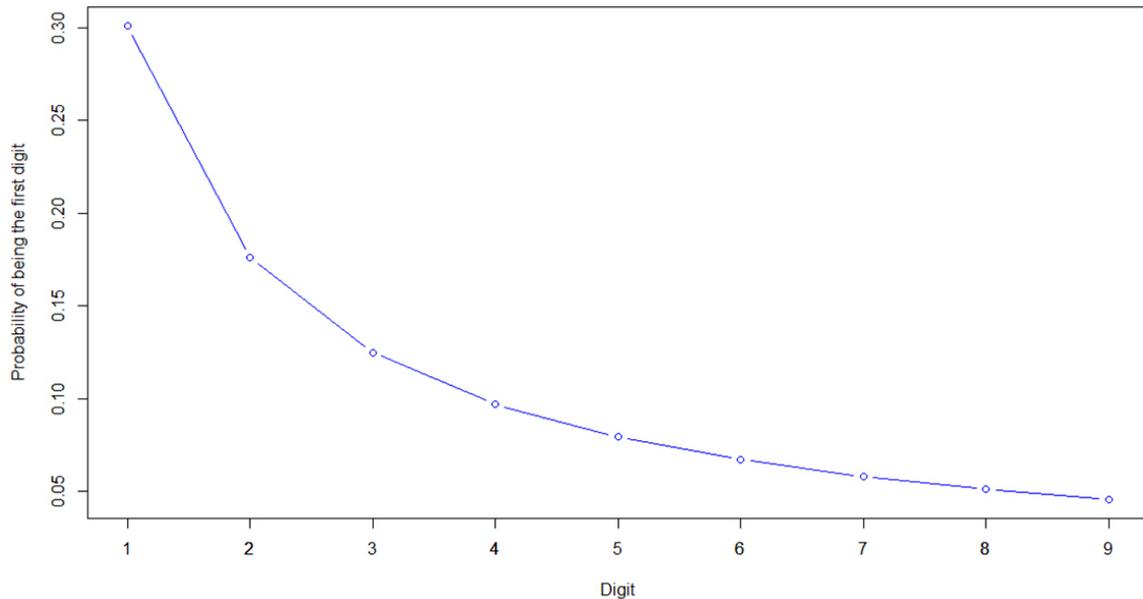
This follows from Chi-squared distributions with k degrees of freedom. One of the major disadvantages of this test is that it is extremely sensitive to sample size, which makes it too rigid for testing purposes (Ley, 1996; Giles, 2007).

Table 1. Probabilities of the numbers from the natural dataset occurring in the first, second, third, and fourth digit position

Digit	Probability of occurring in the first position	Probability of occurring in the second position	Probability of occurring in the third position	Probability of occurring in the fourth position
0	N/A*	0.11968	0.10178	0.10018
1	0.30103	0.11389	0.10138	0.10014
2	0.17609	0.10882	0.10097	0.10010
3	0.12494	0.10433	0.10057	0.10006
4	0.09691	0.10031	0.10018	0.10002
5	0.07918	0.09668	0.09979	0.09998
6	0.06695	0.09337	0.09940	0.09994
7	0.05799	0.09035	0.09902	0.09990
8	0.05115	0.08757	0.09864	0.09986
9	0.04576	0.08500	0.09827	0.09982

Source: Nigrini, 1999, p. 2.

* The probability cannot be defined.

Figure 1. Distribution of the leading digit: a visualization

Source: own work, based on Nigrini, 1999, p. 2.

One possible alternative might be the Kolmogorov-Smirnov test for comparing two empirical distributions by defining the largest absolute difference between the cumulative distribution functions as the measure of the discrepancy:

$$\chi^2(k) = \sup |F_{n_1}(x) - F_{n_2}(x)| \cdot \sqrt{\frac{n_1 \cdot n_2}{n_1 + n_2}} \quad (4)$$

where

k is the total number of observations;

$F_{n_1}(x)$ and $F_{n_2}(x)$ are empirical cumulative distributions of the first and the second sample, respectively;

n_1 and n_2 are the sizes of the first and the second sample, respectively.

According to Stephens (1970), the Kolmogorov-Smirnov test is not biased by sample size and gives more reliable conclusions. However, as noted by Noether (1963), tests based on the null hypothesis of a continuous distribution may not be appropriate for testing discrete distributions. As a result, the test values may be quite conservative in rejecting the null hypothesis, giving false-negative results.

Application of BL in teaching economics

Accounting and finance – tax fraud

The first proposal for applying BL to check the validity of natural number samples was made by Varian (1972). However, BL was still not applied by accountants and tax officers up to the late 1980s, when Carslaw (1988) observed that the distribution of the digits in data reflecting income streams from New Zealand was not in line with BL. Nigrini's works (1996; 1999) on the digital analysis were actually helpful in uncover-

ing cases of tax evasion in the USA. At the same time, some researchers (see Ettredge & Srivastava, 1999) stated that the fact that the distribution of the first digits in the presumably real numbers differs from BL does not necessarily imply fraud: the deviation might arise from flaws and operating inefficiencies in the operating data systems.

Durtschi et al. (2004) defined the cases when BL should or should not be applied in order to recognize fraud. They claim that BL can be used as a reliable detector of fraud i) when the numbers are the combinations (products) of the other numbers (e.g. sales); ii) when the dataset is large enough; iii) when the mean is higher than the median, and the skewness is positive. In contrast, BL will not give reliable conclusions about fraud when: i) the numbers are assigned (e.g. invoice numbers); ii) the numbers are the product of human design (e.g. prices, which tend to end with 99); iii) the numbers come from accounts featuring a large proportion of firm-specific numbers, and iv) when there are minimum and maximum numbers built in.

The last couple of decades have been marked by a substantial increase in the volume of financial and accounting literature showing how to use BL to track fraud and its applicability in forensic accounting (Nigrini, 2012). The *know-how* presented in the majority of papers focused on the operational side of the problem (Simkin, 2010). The focus on the applied aspects of BL in the accounting and financial literature caused the development and extension of these methods (Nigrini, 2012). New and promising areas of application in finance and accounting are anti-money-laundering (Yang & Wei, 2010) and financial statement analysis (Henselmann et al., 2012). Drake's and Nigrini's (2000) methodology can serve as an excellent example of how to introduce BL and digital analysis of accounting

data to students efficiently. This paper can be treated as a very comprehensive instruction for students and practitioners of accounting and auditing.

Microeconomics – training the probability perception

The critical issue related to the modern way of teaching microeconomics is the excessive use of the “chalk-and-talk” approach as well as insufficient attention towards the students’ skills of solving applied problems (Watt, 2011). A BL experiment can be treated as one of a series of activating tools used during applied microeconomics courses. Its main aim is to show how the simplified perception of the probability can result in incorrect perceptions of real-life economic phenomena. Even setting up a simple standard model requires, among other things, a realistic understanding of the probabilities, which is usually outside the agenda of an economics education (Gigerenzer, 2015). The majority of economics textbooks present problems where the probabilities are either explicitly defined or can be derived using simple rules of probability counting (see, for instance, McConnel et al. 2014, Varian 2014, Frank & Cartwright, 2013). Students do not gain any skills in evaluating probabilities on their own; instead, they obtain the information as found in textbook problems.

BL can be treated as one of the Power Laws (PLs), which are a good source of the empirical evidence necessary to develop the skills of realistic probability perception since they facilitate the process of gaining background knowledge about the numerous empirically observed patterns. Firstly, PLs are present in various fields of science and life. One of the best known and commonly mentioned beyond the field of formal science is the Pareto principle, while an additional example is that the size distribution of cities follows Zipf’s Law (1936), analogously to the size of the companies and the stock exchange cumulative returns (Gabaix, 2016). Secondly, the unique thing about PLs is that they break the common perception that the variables are distributed around the mean (i.e., that data generally fit the uniform or normal distribution patterns). Our tendency to average is so strong that even the popular Pareto distribution of income is flattered in the human mind, as Norton and Ariely (2011) showed in their experimental study.

Big data – the new challenge

The development of the field of data science has provided additional opportunities for applying statistical analyses, such as testing BL in many areas of management, accounting, business, and economics. It is part of the “big data” revolution, in which various data are treated as a new production factor. Big data is referred as “high-volume, high-velocity and/or high-variety information assets [...]” (Gartner, 2015, retrieved from Janvrin & Watson, 2017, p. 2). The field of data science as it is understood nowadays is relatively young, but it has already become integral to a wide range of related fields. Teachers need to find a new way of incorporating this change to the existing educational process.

Janvrin and Watson (2017) have analyzed the role of big data in maintaining accounting standards. The big data approach is even more relevant to revealing cases of tax fraud by applying BL because using automated procedures is less costly than developing the human mind. Further developments in data science and the standardization of reporting methods for the tax and financial authorities may also facilitate the development of automated audits. For accounting students, the new tools provide the possibility to analyze both structured and unstructured data using Business Intelligence (BI) technologies and avoiding time-consuming and laborious calculations in Excel. BL is set to become part of the curriculum for accounting students (Drake & Nigrini, 2000).

The big data revolution will also change how we teach economics. The new IT tools make statistical analysis simpler and easier. Admittedly, economics students have no access to typical BL tools due to the relatively high costs, but the combination of open-source R, R-studio and Markdown software makes it possible to conduct studies with no explicit costs. The availability of ready-to-use procedures allows them to carry out such data exploration with little in the way of programming skills and can be a good motivator to learn how to code and to use statistics. The possibility of testing BL seems to be wide open for students and teachers. The increasing number of emerging areas and applications make it more attractive (Berger & Hill, 2015). There are two main areas of using BL in the classroom: i) testing the quality of economic data, and investigations related to scientific fraud and fake data; ii) testing the behavior of forecasts in econometric modeling.

Similarly to tax and financial data, economic data may contain defects resulting from unreliable reporting or intentional manipulation. The exploitation of the data should be preceded by procedures for testing data quality. The literature showed that the credibility of the data used in economic and social science research is moderate or even low (Ioannidis & Doucouliagos, 2013). BL is one of the potential tools available to investigate the problem of data falsification (Michalski & Stoltz, 2013). The application of these new IT tools makes the procedure so simple that even students can become investigators and discover scientific fraud and non-naturality in the data. This can be their first step towards critical thinking about scientific evidence. The experience of investigations of this type can also reduce the moral hazards of students by demonstrating the existence of efficient tools for detecting fraudulent behavior.

An additional and relatively new area of using BL is an application for testing the robustness of the forecasts in econometric modeling. If the input data fits BL, then the output data should also meet the same criterion. The new evidence shows that some outputs from numerical algorithms, transformations of the random variables and the stochastic processes, as well as multidimensional systems, fulfill BL (Berger & Hill, 2015). A test based on BL may be an exciting proposi-

tion to evaluate such models as Dynamic Stochastic General Equilibrium Models (hereafter DSGE), which have no statistical goodness-of-fit measures yet.

Experiment, simulation, and research – BL in the classroom – a case study

The educational tools presented in this section were used to introduce BL during an Applied Microeconomics course, but they can also be used for accounting/finance or data science classes. The first stage of the study is to conduct an experiment; the students have no prior knowledge when providing the answers, and this is expected to have a positive effect on their motivation to learn the subject through the creation of a form of “information deprivation.” The second stage is devoted to the analysis of BL, including the theoretical formulation of legal, real-life examples, and an application of BL in tax fraud detection. The demonstration of the Monte-Carlo simulation is presented to prove the evidence collected by other authors. Finally, the students’ answers are presented. The third stage of the study incorporates an analysis of the IT tools necessary for conducting the experiment and the data analysis.

The tax fraud problem was the central storytelling (or narrative) framework, used to make the problem interesting for the students. To be more precise, they attempted to fool a hypothetical tax officer through providing fictional numbers that appeared to be random. Geyer (2010) used a similar methodology, making BA students play the role of tax evaders. The crucial difference between Geyer (2010) and the present paper is that the latter proves explicitly to the students the impossibility of committing tax fraud in the epoch of big data techniques. In other words, the undergraduate economics students gain valuable experience, which is expected to prevent them from cheating in the future.

The main goal of using the tools was behind the story. It was attempted to show to the students that: i) the straightforward perception of probability can result in inefficiency in the analysis of real-life problems; ii) the possibility of fraud in the big data era is much smaller, and this is explained not only by the tax and financial issues but also by developments in scientific research and public statistics.

Conducting the experiment

During the experiment, the students were asked to add 60 numbers to the fictitious invoices. Their goal was to generate data that would appear to be generated by random factors, not by the human mind. The students received a small number of additional grading points for participation in the experiment, and they also gained extra points for avoiding being caught. The incentive may seem to be non-ethical, as the students received extra points for non-ethical behavior; however, the motivation incentive scheme is correct. The chance that they would receive points for efficient cheating is minimal, as the anti-fraud procedures based on BL work fine. Even after the lecture, a student who knew and understood BL had problems with fictional cheating on the tax authorities because they could not control the frequencies of all the digits. In addition, the students need to experience that their effort to cheat is useless. This experience (i.e. demonstrating how easily fraud can be detected) is a crucial factor, which can influence their further behavior and motivate them to avoid fraud (Joyner, 2011), especially in the light of the public presentation of the results of anti-fraud procedures. In order to avoid the possibility of boycotting the experiments caused by the transparency of the decision, the students were asked to enter an anonymous nickname during the experiment (see the first screen of the experiment, Fig. 2). They could recognize their results while remaining anonymous on

Figure 2. Initial screen in the BL experiment

Welcome to the experiment!

We want to find out if you would be able to cheat on your tax returns. It doesn't matter whether you know the rules of accounting - this is a very simple experiment:

- Suppose you want to deceive a number of items that increase your costs and thus reduce the tax base.
- You have to do this for 4 months
- These items are fake, but you can document them with fictitious invoices
- You only need to enter a value of the fake invoice
- Do not worry about the relationship between the values you provide. It might be any number; the accuracy should be given with a precision of 1 cent. The decimal is a dot.

For instance, insert the number:
 2 digit number --> 12.3
 3 digit number --> 456.78
 2 digit number --> 90

Your only goal in the experiment is to enter such numbers that would seem to be generated by random factors, not designed by you.

Your numbers would be analyzed using the algorithm for finding out the cases of tax evasion used by the tax officers. Your main aim is not to be caught. You will be graded 2 \$ FBEE for participation in the experiment and 3 \$ FBEE, if you manage to deceive on the tax officers.

I will publish the experimental results on the site (as an animation). Enter a unique nickname, thanks to it i) you can recognize your result i) you stay anonymous.

Nickname

Source: own experiment, programmed in labsee.com.

the animation presenting the results of the antifraud algorithm (see Fig. 2).

The experiment is quite short and can be conducted as the first part of the lecture or as prior homework. The students have to fill in the gaps with numbers on all four screens representing the hypothetical monthly accounts (see Fig. 3). To make the task more complicated, the students must enter the numbers using a pre-defined number of digits.

The experiment was conducted using the labsee.com platform.¹ The platform offers a variety of tools for conducting online synchronous and asynchronous experiments and surveys; using this platform requires basic skills in Java programming. The advantage of the using labsee.com platform is the instructor's ability to control the experiments in real-time during the lecture. However, if the experiment is performed asynchronously, the instructors are free to use any other online platform.

Introducing BL by the simulation and analysis of real data

After all the participants submit their responses, the instructor should proceed to introduce and explain BL. The proposed method of doing this is split into several stages: i) explaining BL using the Monte Carlo simulation and theory presented in the first section of the present paper; ii) proving that real-life data follow BL; and iii) showing and discussing the results of the experiment.

The Monte Carlo simulation serves as a simple thought experiment, which shows the misleading per-

ception of a probability based on the prior student's experience about the distribution of values around the mean. In the first part of the experiment, they should imagine one bag containing nine ping-pong balls, labeled from 1 to 9, and the other two bags containing ten ping-pong balls labeled from 0 to 9. If the participant is asked to close his eyes and withdraw a random ball from the first bag, what would be the probability of pulling out a ball labeled "7"? According to theory and common sense, the probability should be 1/9. The same would be applicable to any other number. For the second and third bag, the probability of pulling out a ball with a random number should be 1/10. The MC simulation *ball_drawings.html*² presents the visualization of the sequential drawings, which mimics the process of the random choice of 60 samples from three digit numbers (see Fig. 4).

The main observation that should be stressed based on the simulation is that for a small number of repetitions, it is difficult to find any patterns in the generated data. However, as the number of draws grows, the probability is consistent with the expected uniform distribution (the last screen shows the results of 10 000 draws). After this simulation, it is the right time to introduce BL using the suspense technique. The teacher should ask the students whether they used the kind of reasoning presented in the Monte Carlo simulation. The majority of students will probably confirm this. Then the teacher should follow the narrative structure and create the tension by announcing that if this was their strategy, then they have been caught on cheating on the invoice

Figure 3. Design of the BL Experiment

Month 1/4

Enter values of the fake invoices. It might be any number; the accuracy should be given with a precision of 1 cent. You need to provide such numbers that would seem to be generated by random factors, not designed by you.

1. Office supplies expenditure (2 digit numbers)
a b c d

2. Cleaning service expenditure (3 digit numbers)
a b c d

3. Expenditure on external analysis (5 digit numbers)
a b c d

4. Expenditure on marketing (5 digit numbers)
a b

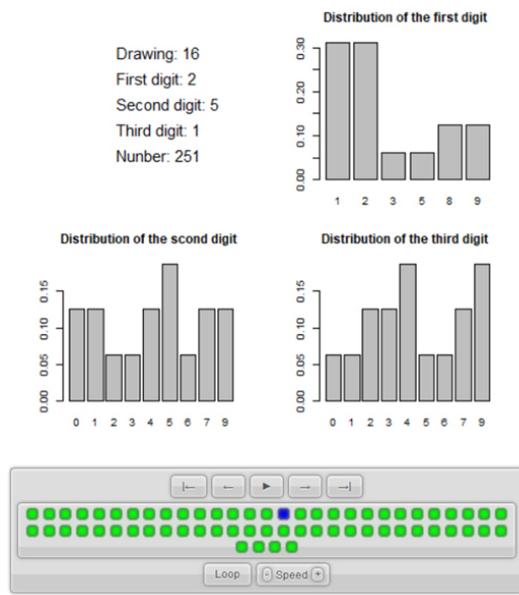
5. Expenditure on legal services (6 digit numbers)
a

Source: own experiment, programmed in labsee.com.

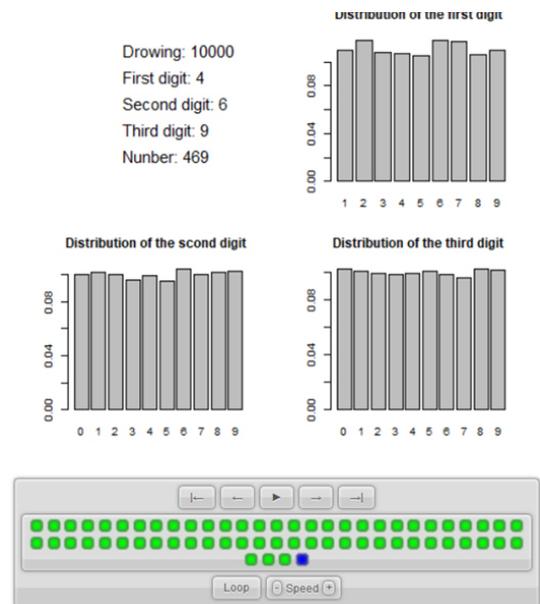
¹ Labsee.com is a platform designed for conducting large-scale online economic experiments.

² One can find the R-project to generate the presented visualizations in the online annex; alternatively, there are ready-to-use visualizations (see Fig. 4).

Figure 4. Simulation of drawing random numbers



Source: own analysis in R in animation package (Xie, 2013).

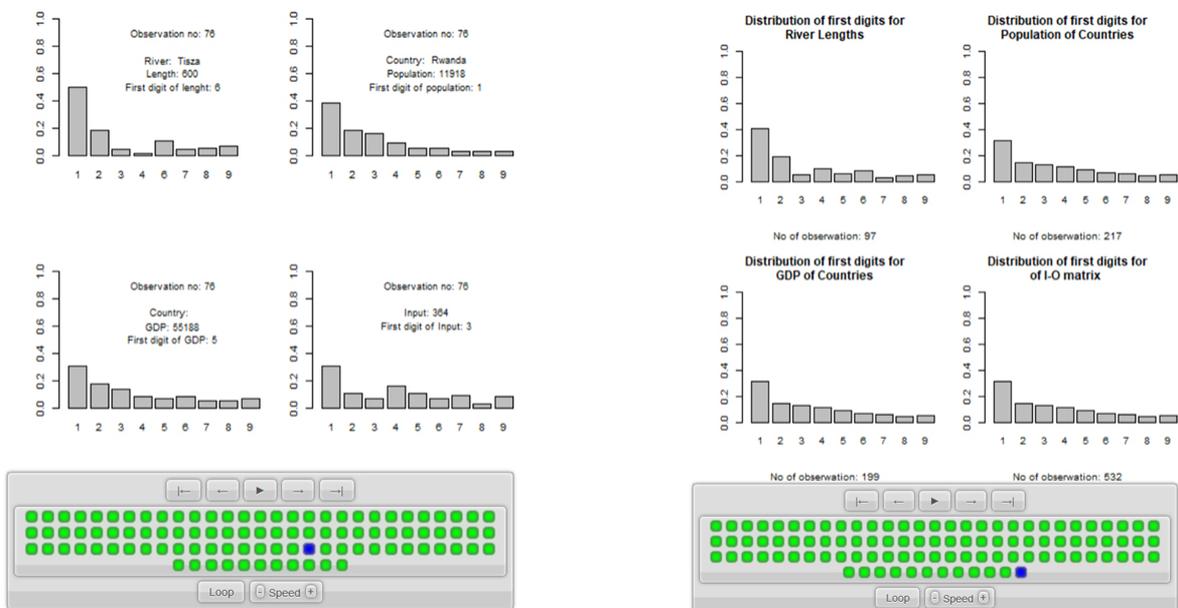


experiment because the actual distribution of digits is significantly different.

The instructor should present visualizations of the first digit distribution in the empirical datasets in order to show that natural data flows suit BL. The visualization *empirical_data.html* includes four data samples. The first three are real data describing: i) the lengths of the 98 longest rivers in the world; ii) the populations of the majority of countries; and iii) the GDP of the majority of countries, respectively. The fourth data set is the Input-Output (I-O) matrix

used in the estimation of the DGSE model (Kiula, 2018). The visualization (see Fig. 5) shows that even for a relatively small number of observations, it is easy to see a common pattern in the distribution of first digits (Fig. 5a). The first digits are not uniformly distributed. For any digit, the frequency of occurrence in the first position is inversely related to its rank: for instance, the digit 1 is much more frequent than the other digits. For the full sets of observations (Fig. 5b), the distribution of all the data is nearly identical and follows BL.

Figure 5. Frequencies of the first numbers of the analyzed datasets (rivers, populations, GDP, I-O matrix): a) sample 1 to N; b) full dataset



Source: own analysis in R in animation package (Xie, 2013).

Discussing the results and post-experimental activities

The final stage is discussing the results of the classroom experiment. After introducing BL in a functional form with relevant real-life examples, the teacher should present its applications in detecting tax fraud (Nigrini, 2012; Simkin, 2010) and show the summary visualization of the results of the antifraud procedures applied to the experimental data. The analysis was performed using the R-CRAN package *BenfordTests* (Joenssen, 2015). The first stage of the procedure is a "red flag indicator" based on the digits' p-value. If there is a statistically significant difference between the frequency assigned by the participant and the frequency predicted by BL (i.e., if the p-value is higher than 0.1), the flag is set. The second stage is the Kolmogorov-Smirnov goodness-of-fit test. With the use of the automatizing R codes, the visualization is ready immediately after finishing the experiment (see supplementary online materials).

An essential part of the visualization is to present the participants' nicknames only on the screen. The results are presented publicly, and the students can easily see and recognize their responses while remaining completely anonymous. In psychology, the experience can be personally transformative if it changes one's point of view (Paul, 2013). Being caught cheating in this way is a valid form of experience, even if it is

only a game. If future decisions on whether to cheat is based on a perception of the probability of not being caught, then the obtained results leave no illusions. Even simple statistical procedures can indicate fraud exceptionally effectively. The experiment was conducted twice (with groups of 10 and 60 people), and all the students were flagged.

The simplicity of the BL test (see Fig. 6) can be good motivation for students to conduct their own investigation. The students can apply the ready-to-use R codes, enabling them to apply the BL test with no prior experience in coding. The rest of the attached codes are more complicated, mainly because of the publication purposes, but even students and teachers with little or no coding experience can use and modify them; the codes are free and available for everyone.

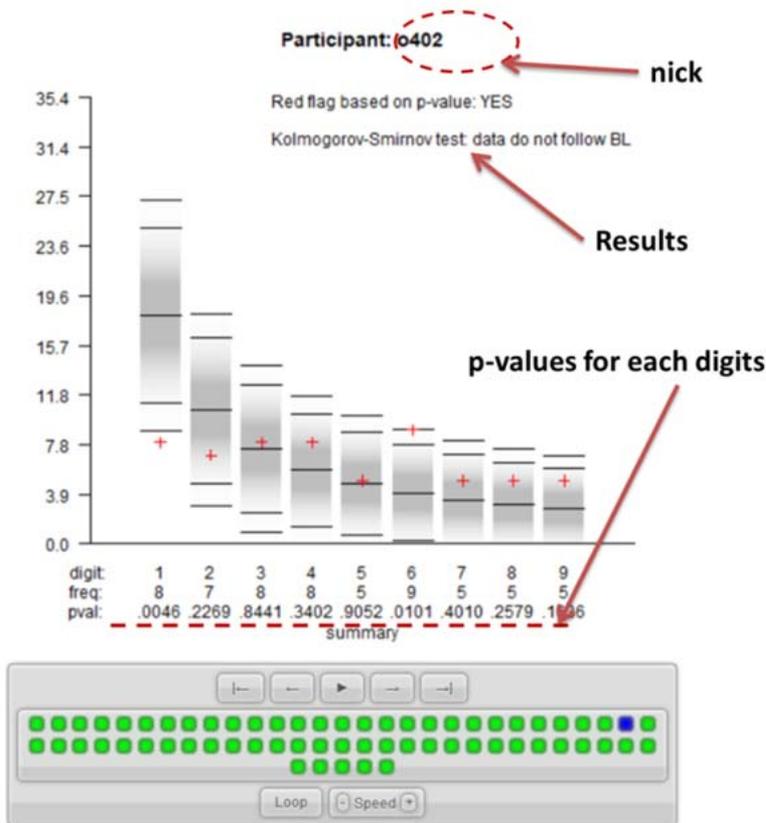
There are numerous sets of economic data that have not been tested for the possibility of mistakes, errors, tax fraud or even the scientific fraud. In international trade, importers usually avoid reporting large volumes, as this may require a higher tariff rate. From this perspective, international trade statistics can be an exciting test area for applying BL in order to identify fraud.

The empirical distributions of the first digits are not consistent with BL distributions for some years (see Fig. 7 and supplementary online materials). For such a large sample, the presented deviation from BL can be a good motivation for further detailed investigation.

For students of more advanced quantitative methods, it is worth discussing two papers devoted to i) one of the most straight forward explanations of BL (Fewster, 2009); and ii) why the presented explanations of BL are still not satisfactory (Berger & Hill, 2011). The latter paper criticizes "folk" explanations of BL (such as the "birthday paradox"), pointing out that although they seem to be intuitive, they do not pass the test of solid mathematical analysis. In other words, BL still remains a kind of mystery.

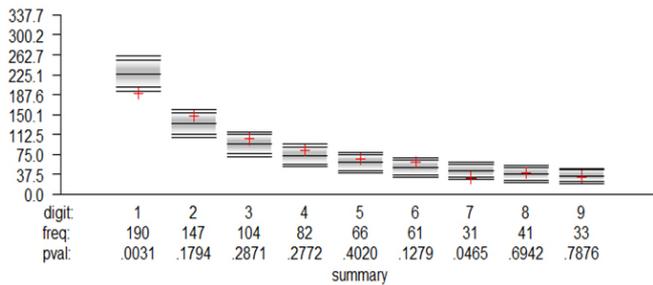
Playing with BL accidentally creates mystery and the atmosphere of crime puzzles. For a group of MA students, this issue was so interesting that they spontaneously came up with the idea of a contest. During the contest, a team of "creative accountants" and another of the "tax authority" competed. The goal of the former team was to generate such datasets that would not be detectable by the latter group. After some modifications, the contest seems to have become an auspicious tool

Figure 6. An example visualization of the results of a classroom experiment



Source: own work, based on R and Benford Tests (Joenssen, 2015), available in online materials.

Figure 7. An example of the empirical distribution of the first digit in the volumes of exports between EU Member States for the year 2015



K-S Test for Benford Distribution

data:simple_data[, 1]

D = 1.3567, p-value = 0.01506

Source: own work based on IMF Direction of Trade statistics and R package Benford Tests (Joensuu, 2015), available in online materials.

to inspire students to make additional effort during quantitative methods courses.

The mystery of BL touched the authors too. How can one explain the result of a simple MC experiment? The experiment can be conducted in N-steps.

Step 1: From the sample of natural numbers ranked from 1 to 999, a number p_1 is randomly picked using a random number generator with a uniform distribution.

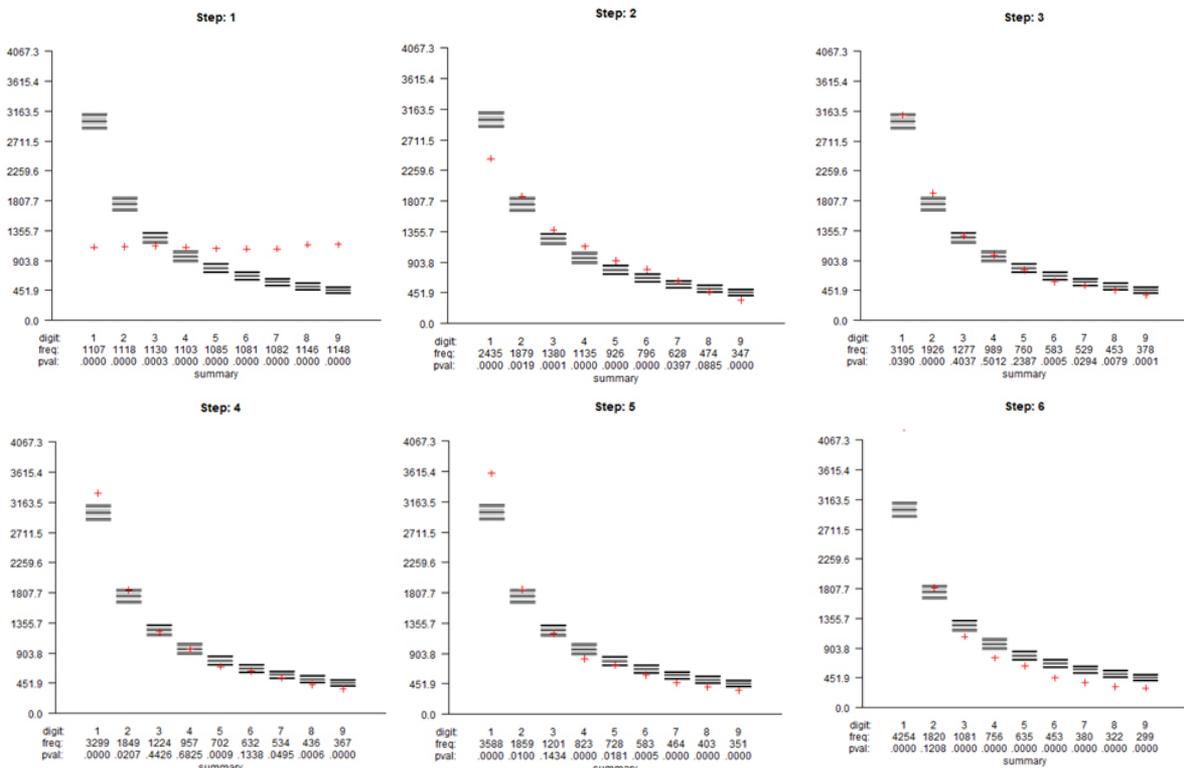
Step 2: From the sample of natural numbers ranked from 1 to p_1 , a number p_2 is drawn using the same techniques as in the first step.

Step 3: From the sample of natural numbers ranked from 1 to p_2 , a number p_3 is drawn using the same technique as in step one. [...]

Step N: From the sample of natural numbers ranked from 1 to p_n , a number p_{n+1} is drawn using the same technique as in step one.

The entire procedure should be replicated 10,000 times, which should result in N vectors containing all the randomly picked numbers p for each step. For each such vector, the first-digit law is tested. The results obtained from step 1 are similar to the ball drawing simulation with a uniform distribution. More steps causes number 1 to be more frequent (see Fig. 8), and the distribution approaches the BL pattern. This creates a puzzle: why are only 3 steps required to generate the numbers which follow BL? For more than 3 steps, the simulated distribution moves away from the theoretical distribution: digit 1 becomes much more frequent.

Figure 8. Visualization of the first six steps in the Monte-Carlo simulation



Source: own application, based on R and Benford Tests (Joensuu, 2015), available in online materials.

The experiment and the prepared MC simulations can be used in a wide range of academic courses, such as accounting, applied microeconomics, and quantitative methods. The actual scheme chosen to present the material depends on the subject of study. The presented scheme was designed around an Applied Microeconomic course for data science students, but the materials can be used like Lego bricks and easily adjusted to one's needs.

Conclusions

This paper presents a simple in-class experiment and Monte Carlo simulations. Its goals are twofold. The first is to familiarize the students with the existence and the properties of BL, which is one of the "gems of statistical folklore" (Berger & Hill, 2011). The second is to achieve vital teaching goals. One of the leading teaching goals in this experiment was to train the students' skills in the realistic perception of probabilities, which does not currently form part of microeconomics courses. The experiment, therefore, attempts to demonstrate that the simplified perception of probabilities may result in a failure during real-life data analyses. The additional goal was to train the students' skills in the critical assessment of data, as the frequent use of unreliable or fake data is a continuing problem in the social sciences. The demonstration of how easily fraud may be detected is expected to diminish the motivation of students to cheat in their courses, or, even in their professional career. Finally, the presented classroom experiment can be used to familiarize the students with the basic IT tools, necessary for the simple data analysis.

The authors will continue to create new materials concerning BL and generally probability and risk perception. We are happy to share new experiments and simulations at our site.

References

- Benford, F. (1938). The Law of Anomalous Numbers. *Proceedings of the American Philosophical Society*, 78(4), 551–572. Retrieved from <http://www.jstor.org/stable/984802>
- Berger, A., & Hill, T.P. (2011). Benford's law strikes back: no simple explanation in sight for mathematical gem. *The Mathematical Intelligencer*, 33(1), 85–91.
- Berger, A., & Hill, T. P. (2015). *An introduction to Benford's law*. Princeton, NJ: Princeton University Press.
- Carlsaw, C.A.P.N. (1988). Anomalies in Income Numbers: Evidence of Goal Oriented Behavior. *The Accounting Review*, 63(2), 321–327. Retrieved from <http://www.jstor.org/stable/info/248109>
- Cho, W.K.T., & Gaines, B.J. (2007). Breaking the (Benford's) law: Statistical fraud detection in campaign finance. *American Statistician*, 61(3), 218–223. DOI: <https://doi.org/10.1198/000313007X223496>
- Drake, P.D., & Nigrini, M.J. (2000). Computer assisted analytical procedures using Benford's Law. *Journal of Accounting Education*, 18(2), 127–146. DOI: [https://doi.org/10.1016/S0748-5751\(00\)00008-7](https://doi.org/10.1016/S0748-5751(00)00008-7)
- Durtschi, C., Hillison, W., & Pacini, C. (2004). The Effective Use of Benford's 'Benford's Law to Assist in Detecting Fraud in Accounting Data. *Journal of Forensic Accounting*, 5(1), 17–34.
- Ettredge, M.L., & Srivastava, R.P. (1999). Using Digital Analysis to Enhance Data Integrity. *Issues in Accounting Education*, 14(4), 675–690. DOI: <https://doi.org/10.2308/iace.1999.14.4.675>
- Falk, R., & Konold, C. (1997). Making sense of randomness: implicit encoding as a basis for judgment. *Psychological Review*, 104, 301–318. DOI: 10.1037/0033-295X.104.2.301
- Fewster, R.M. (2009). A simple explanation of Benford's law. *American Statistician*, 63(1), 26–32. DOI: <https://doi.org/10.1198/tast.2009.0005>
- Frank, R., & Cartwright, E. (2013). *Microeconomics and behaviour*. McGraw Hill.
- Furlan, L. (1948). *Das Harmoniegesetz der Statistik: Eine Untersuchung über die metrische Interdependenz der sozialen Erscheinungen*. Basel, Switzerland: Verlag für Recht und Gesellschaft.
- Gabaix, X. (2016). Power Laws in Economics: An Introduction. *Journal of Economic Perspectives*, 30(1), 185–206. DOI: <https://doi.org/10.1257/jep.30.1.185>
- Gartner. (2015). APM – Gartner IT Glossary. Retrieved from <http://www.gartner.com/it-glossary/application-performance-monitoring-apm/>
- Gauvrit, N., Houillon, J.C., & Delahaye, J.P. (2017). Generalized Benford's law as a lie detector. *Advances in Cognitive Psychology*, 13(2), 121–127. DOI: <https://doi.org/10.5709/acp-0212-x>
- Geyer, D. (2010). Detecting Fraud in Financial Data Sets. *Journal of Business & Economic Research*, 8(7), 75–83.
- Gigerenzer, G. (2015). *Calculated risks: How to know when numbers deceive you*. New York: Simon and Schuster.
- Giles, D.E. (2007). Benford's law and naturally occurring prices in certain eBay auctions. *Applied Economics Letters*, 14(3), 157–161. DOI: <https://doi.org/10.1080/13504850500425667>
- Henselmann, K., Scherr, E., & Ditter, D. (2012). Applying Benford's Law to individual financial reports: An empirical investigation on the basis of SEC XBRL filings. *Working papers in accounting valuation auditing*. Retrieved from <https://ideas.repec.org/p/zbw/fauacc/20121r.html>
- Hill, T. (1995). A statistical derivation of the significant digit law. *Statistical Science*, 10(4), 354–363. DOI: 10.1214/ss/1177009869
- Ioannidis, J., & Doucouliagos, C. (2013). What's to know about the credibility of empirical economics? *Journal of Economic Surveys*, 27(5), 997–1004. DOI: <https://doi.org/10.1111/joes.12032>
- Janvrin, D.J., & Weidenmier Watson, M. (2017). "Big Data": A new twist to accounting. *Journal of Accounting Education*, 38, 3–8. DOI: <https://doi.org/10.1016/j.jaccedu.2016.12.009>
- Joenssen, D.W. (2015). Benford's Tests: statistical tests for evaluating conformity to Benford's law. Computer Software. Retrieved from <https://cran.r-project.org/web/packages/BenfordTests/index.html>
- Joyner, E. (2011). Detecting and preventing fraud in financial institutions. *SAS Global Forum 2011*, 1–16. Retrieved from <http://support.sas.com/resources/papers/proceedings11/029-2011.pdf>
- Kiuiila, O. (2018). Decarbonisation perspectives for the Polish economy. *Energy Policy*, 118, 69–76. DOI: <https://doi.org/10.1016/j.enpol.2018.03.048>

- Ley, E. (1996). On the Peculiar Distribution of the U.S. Stock Indexes' Digits. *American Statistician*, 50(4), 311–313. DOI: <https://doi.org/10.1080/00031305.1996.10473558>
- McConnell, C.R., Brue, S.L., Flynn, S.M. (2014). *Microeconomics*. McGraw-Hill Education; 20th edition.
- Michalski, T., & Stoltz, G. (2013). Do countries falsify economic data strategically? Some evidence that they might. *Review of Economics and Statistics*, 95(2), 591–616. DOI: https://doi.org/10.1162/REST_a_00274
- Newcomb, S. (1881). Note on the frequency of use of the different digits in natural numbers. *American Journal of Mathematics*, 4(1), 39–40.
- Nigrini, M. (1999). I've Got Your Number: How a mathematical phenomenon can help CPAs uncover fraud and other irregularities. *Journal of Accountancy*, 187(5), 79–83. Retrieved from <http://www.journalofaccountancy.com/issues/1999/May/nigrini>
- Nigrini, M.J. (1996). A Taxpayer Compliance Application of Benford's Law. *Journal of the American Taxation Association*, 18(1), p. 72–91. Retrieved from <https://www.econbiz.de/Record/a-taxpayer-compliance-application-of-benford-s-law-nigrini-mark-john/10001202885>
- Nigrini, M.J. (2012). *Forensic Analytics: Methods and Techniques for Forensic Accounting Investigations*. DOI: <https://doi.org/10.1002/9781118386798>
- Noether, G.E. (1963). Note on the Kolmogorov statistic in the discrete case. *Metrika: International Journal for Theoretical and Applied Statistics*, 7(1), 115–116. DOI: <https://doi.org/10.1007/BF02613966>
- Norton, M.I., & Ariely, D. (2011). Building a better America—one wealth quintile at a time. *Perspectives on Psychological Science*, 6(1), 9–12. DOI: <https://doi.org/10.1177/1745691610393524>
- Paul, L.A. (2013). *Teaching Guide for Transformative Experience*. Retrieved from <https://lapaul.org/papers/teaching-guide-for-transformative-experience.pdf>
- Sambridge, M., & Tkalčić, H. (2010). Benford's law in the natural sciences. *Geophysical Research Letters*, 37(22). DOI: <https://doi.org/10.1029/2010GL044830>
- Sambridge, M., Tkalčić, H. & Arroucau, P. (2011). Benford's Law of First Digits: From Mathematical Curiosity to Change Detector. *Asia Pacific Mathematics Newsletter*, 1(4), 1–5.
- Simkin, M.G. (2010). Using Spreadsheets and Benford's Law to Test Accounting Data. *ISACA Journal*, 1, 47–52.
- Stephens, M.A. (1970). Use of the Kolmogorov-Smirnov, Cramer-Von Mises and Related Statistics Without Extensive Tables. *Journal of the Royal Statistical Society. Series B (Methodological)*, 32(1), 115–122. DOI: <https://doi.org/10.1111/j.2517-6161.1970.tb00821.x>
- Varian, H.R. (1972). Benford's Law. *The American Statistician*, 26, 65–66.
- Varian, H.R. (2014). *Intermediate Microeconomics: A Modern Approach: Ninth International Student Edition*. New York: WW Norton & Company.
- Watt, R. (2011). *The Microeconomics of Risk and Information*. New York: Palgrave Macmillan.
- Xie, Y. (2013). Animation: An R Package for Creating Animations and Demonstrating Statistical Methods. *Journal of Statistical Software*, 53(1). DOI: <https://doi.org/10.18637/jss.v053.i01>
- Yang, S., & Wei, L. (2010). Detecting money laundering using filtering techniques: A multiple-criteria index. *Journal of Economic Policy Reform*, 13(2), 159–178. DOI: <https://doi.org/10.1080/17487871003700796>
- Zipf, G. (1936). *The Psychobiology of Language*. London: Routledge.

Abstract

This paper presents a classroom experiment, the related simulations, and a form of research which familiarizes students with BL. This law is widely used in tax fraud detection procedures. This paper shows that: i) BL can be useful in extending the simple perception of probability, which is presented in the lectures as concerning risk, ii) can be an excellent example of using data processing for classroom tasks, and iii) the experience of fraud detecting techniques may help students change their attitudes to cheating. The experiment and the prepared R codes can be used in numerous courses, such as accounting, applied microeconomics, and quantitative methods.

Keywords: Benford's Law, probability perception, tax fraud, scientific fraud, R-CRAN

Tomasz Kopczewski is a lecturer and researcher at the Faculty of Economic Sciences at Warsaw University. In his research work, he concentrates on creating educational tools based on experiments whose role is to support cognition and the understanding of different economic phenomenon in the context of everyday life. He promotes experiential learning in such fields as experimental economy, Monte Carlo simulations, and Agent-Based Computational Economics modeling. He also carries out experiments using symbolic calculations applying Computer Algebra Systems.

Iana Okhrimenko is a doctoral student at the Faculty of Economic Sciences at Warsaw University. Her research interests refer to the social context of economic decisions, the principles of ecological rationales and the means that enable the teaching of these issues within the teaching economics programs.



Modern Perceptions of Career Success

Adam Metelski*

This article is an attempt to determine the modern meaning of career success. The perception of career success has undergone changes in recent years, with subjective indicators such as job satisfaction and achievement of one's own professional goals growing in importance. The present article reviews the relevant literature and presents the results of the author's own study on the meaning of career success conducted among students of economics. The results indicate that career success is defined subjectively in the modern world, and is no longer confined to the objective indicators commonly applied in the literature. Thus organizations may find traditional incentive tools to be increasingly ineffective.

The concept of career success in relevant literature

Prior to defining the complex term *career success*, it is first necessary to define the meaning of the simple term *success*. Dictionaries define it as *the achieving of positive results, such as in the case of an event; accomplishment, triumph* (Sobol, 2005, p. 973). Success can be understood as the sum of accomplishments in particular social roles, e.g. those of a husband, superior, father or friend, or as achievements in a given field, e.g. at work (Młodawska, 2015).

In the case of career success, several definitions exist. Judge et al. define it as "positive psychological or work-related results or personal and professional accomplishments one has accumulated as a consequence of work experiences" (Judge, Cable, Boudreau and Bretz, 1995). Arthur, Khapova and Wilderom (2005, p. 179) define career success as the achieving of desired work-related results at any moment in an individual's career experience. Bohdziewicz (2008, p. 279) claims that the principal indicator of success used by individuals is the achievement of the long-term professional goals they set for themselves. The above definitions demonstrate that career success is not a precisely-defined term. Many scholars forgo

defining the term, instead directly proceeding to operationalize it (Gunz and Mayrhofer, 2011, p. 253).

Gunz and Mayrhofer (2011) believe that career success should be analyzed from three primary perspectives: conditionary, boundative and temporal. In other words, career success is a state an individual is in at a given moment in time, limited by social space and seen within the context of that person's entire career path. A good example which illustrates this model is that of a sailor. Knowing only his location at sea, it is difficult to determine whether his journey is a success. This is due to the fact that we lack information on where he sailed from, his destination and time spent at sea. Similarly, it is difficult to compare how successful several sailors would be if they were in a similar location as a great deal of important data is missing: the performance of their boats, departure times, whether there were any problems along the way and what the weather was like. By the same token, based only on a person's income, it is difficult to assess their career success as it is also important to know how that person reached the position in which they are able to earn that amount. Was it a result of taking over a prosperous family business, or was it perhaps achieved after years of hard work climbing the career ladder? Gunz and Mayrhofer (2011) propose a framework for conceptualizing career success. First, an individual's situation is analyzed from the perspective of their status, health, being proud of any accomplishments, job satisfaction etc. The difficulties and hurdles encountered along the way are then analyzed, as it is important to know the context of and interpret biographical events. Finally, the temporal perspective is determined, as the amount of time the individual required to achieve their position in life is a critical indicator of career success. It is also recommended to regularly take into account theories from other fields, including economics, psychology, sociology and management.

* Poznan University of Economics, Poland

Objective and subjective indicators of career success

The literature most frequently lists two criteria of career success: objective – measurable, accessible to external subjects, and subjective – accessible only to the person in question (Arthur et al., 2005; Gunz and Mayrhofer, 2011; Heslin, 2005; Judge et al., 1995; Schomburg, 2007). Objectively, career success can be described using observable and measurable indicators such as pay, promotion and the social status of a profession. The majority of researchers focus on objective indicators (Judge et al., 1995). Subjective career success, on the other hand, is related to the feelings one has towards a job. The primary indicator in this case is job or career satisfaction, in addition to being proud of one's accomplishments and work-life balance. The concept of job satisfaction is a popular one among economists and psychologists, as evidenced by the number of terms and definitions developed in these areas (Sowińska, 2014). Locke (1976, p. 1300) defines it as a "pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences". Career satisfaction, on the other hand, is defined as one's satisfaction resulting from the internal and external aspects of one's career, including pay, promotions and development opportunities (Greenhaus, Parasuraman and Wormley, 1990).

It is important to remember the relation between objective and subjective career success (Gunz and Heslin, 2005). Some researchers claim that objective success influences subjective success (Poole, Langan-Fox and Omodei, 1993), assuming that career success is determined by one's income or prestige, and that individuals appraise their success based on objective achievements. However, other researchers believe subjective success to be more important than objective success (Aryee, Chay and Tan, 1994). Proponents of this view are primarily psychologists, who hypothesize that there exists a relation between personality, attitude and career success. Others propose that the subjective and objective aspects of career success could be intertwined (Seibert, Kraimer and Liden, 2001). It is possible that this interdependence develops over time (Arthur et al., 2005) – individuals experiencing objective reality may develop an image of what career success means. An example of this is the organizational "age norms" – a notion commonly held by employees of an organization regarding the age at which someone should be promoted to a given position.

Heslin (2005) claims that changes have occurred over recent decades which have diminished the importance of certain objective indicators of career success. One of these factors is the importance of development via hierarchical promotion (Kawka, 2014, p. 107). Many specialists and managers work as contractors and consultants (Ganiron, 2013), which leads to a decline in promotion as the primary indicator of success. The imperfect nature of objective indicators such as pay and promotions also stems from the fact that, for a certain part of the population, they are not the

primary indicators of success. For example, teachers may appraise their careers based on the performance of their students, taxi drivers may base their appraisals upon the number of years without traffic accidents, and doctors based on the number of patients saved. In such cases, even if certain achievements do not result in a higher pay or promotion, one's appraisal of career success may be high. Many individuals strive for less measurable achievements, such as work-life balance or a sense of purpose.

The importance of objective and subjective aspects is effectively illustrated in Friedman and Greenhaus (2000). More than 800 employees were asked to assign relative importance to 15 potential indicators of career success. The analysis of the results rendered it possible to identify five dimensions of career success: 1) status, 2) leisure time, 3) challenge, 4) security and 5) social factor. Apart from status, all these aspects are subjective criteria and extend beyond objective factors such as prestige, power, money or promotions. This disregard for objective factors may stem from the fact that high pay and promotion do not always make individuals proud or happy. In reality, the opposite may be true, as a promotion and pay raise may sometimes result in alienation and depressive reactions (Heslin, 2005). This may happen in a situation where a newly-appointed manager fails to delegate responsibilities sufficiently quickly and becomes overburdened with work. This may lead to a depressive reaction and both an objective and subjective lack of career success.

Subjective appraisals of career success are most frequently described in terms of job satisfaction (Ganiron, 2013, Gunz and Heslin, 2005, Gunz and Mayrhofer, 2011). This stems from the belief that someone who is satisfied with many aspects of their job probably believes that they have achieved career success. However, Heslin (2005) lists certain limitations concerning the use of job satisfaction as an indicator of career success. First, a person who believes in having a good career will not always think otherwise when they enter a new work place which does not meet their expectations. Second, an individual may be satisfied with their current position, but dissatisfied with their professional achievements in general. Third, a satisfying job with limited growth potential may offer a minimal sense of career success. Fourth, an individual may even greatly dislike their current job, but may be satisfied with their career due to its prospects. The best example here are students who apply for internships which are not always satisfying, but are believed to constitute an investment in their future. Fifth, high job satisfaction may not always lead to a subjective sense of career success, in particular if health and family life is sacrificed as a result. In conclusion, it should be emphasized that job satisfaction is only one of several elements of subjective career success. A subjective appraisal of career success consists of an individual's reactions to actual and expected career-related developments. It is also influenced by one's sense of identity, purpose and work-life bal-

ance, thus making it significantly more complex than satisfaction with one's current position.

Most important factors determining career success

A study was conducted in thirty countries to determine what executives of medium and large enterprises consider career success (Cesarz-Kwietniak and Sawicka, 2013). In the majority of the countries studied, work-life balance was the most frequently-listed factor. Only in Poland and three other countries was pay the dominant factor. This most likely stems from the fact that, compared to Western Europe, Poland is still a developing country where it is necessary to work hard to live on a level close to the European average. Figure 1 contains the factors of career success considered important in Poland and the rest of the world (respondents could select multiple answers).

It is worth noting that career priorities change with age. An important aspect of the above study (Cesarz-Kwietniak and Sawicka, 2013) was the division of respondents into three age groups: the post-World War II baby boom generation (born between 1946 and 1964), Generation X (1965–1978) and Generation Y (1979–1994). This division was applied because age influences career priorities, as 51.1% of Generation Y respondents considered pay to be the most important career success indicator, with as little as 38.1% of those born before 1964 listing it as the dominant factor. A possible explanation is that young people are only now beginning to earn money and aspire to obtain material wealth such as cars, travel, apartments etc. It should also be noted that age influences job satisfaction levels. Young people most frequently expressed dissatisfaction regarding their current jobs (only a 22% satisfaction rate), with baby boomers being least likely to do so (47% satisfaction rate). It is interesting to note

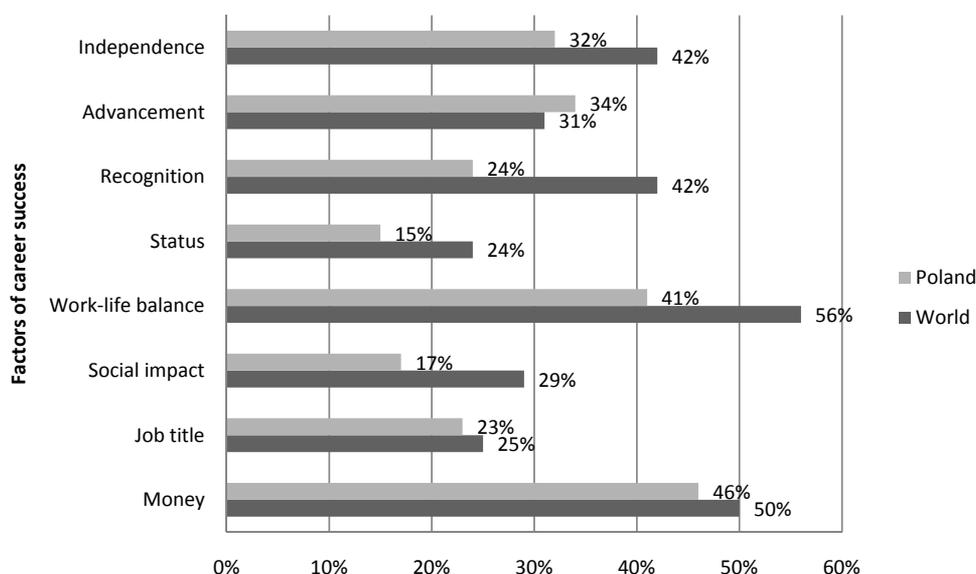
that gender also had an impact on factor selection. Men considered money to be the most important factor, while women preferred to have a work-life balance. To conclude, it is worth noting that more than two-thirds of all respondents believed it was possible to have a successful career and private life at the same time. Moreover, being able to balance the two was the fundamental criterion influencing the career decisions of a large group of respondents.

It is also worth presenting what the respondents of *Diagnoza Społeczna (Social Diagnosis; Czapiński and Panek, 2015)* considered to be the most important career factors. In all four *Social Diagnosis* editions analyzed (conducted in 2009, 2011, 2013 and 2015), "adequate pay" was selected most frequently. A detailed distribution of the most frequently chosen answers can be found in Table 1. The respondents could select from among 12 factors. For example, in 2015, the fourth and further most frequently chosen factors were: *work matching one's skill set* (29.4%), *independence* (21.6%), *personal development* (21.4%), *convenient hours* (16.8%), *opportunities for rapid promotion* (4.1%), *long vacation* (3.4%), *respect* (3.1%), *being able to work from home* (2.9%) and *other factors* (1.9%). These results are in line with Byłok's (2005, p. 87) claim that:

It is money that becomes one of the most important indicators of success in modern society. This results in the market becoming an arena for economic rivalry, like a game where money is the measure of success. One of the consequences of financial success is the individual prestige of being a successful person.

In another study, respondents were asked to select what in their opinion are the characteristics of a successful career (Firkowska-Mankiewicz, 1999). The most frequent associations included various

Figure 1. Factors determining professional success according to international study participants



Source: author's own work based on Cesarz-Kwietniak and Sawicka (2013).

Table 1. Most important professional factors

Year	Three most frequently chosen answers and their percentages		
2009	1. Adequate pay 76.4	2. Lack of tension or stress 52.2	3. Job security 49.0
2011	1. Adequate pay 67.1	2. Lack of tension or stress 55.7	3. Job security 51.7
2013	1. Adequate pay 65.0	2. Job security 54.4	3. Lack of tension or stress 53.3
2015	1. Adequate pay 68.6	2. Lack of tension or stress 60.0	3. Job security 58.6

Source: author's own work based on the *Diagnoza Społeczna* integrated database, www.diagnoza.com [09.05.2017].

characteristics related to material wealth, e.g. *having money, getting hold of something*. Less frequent were connotations related to work and position, e.g. *being satisfied with one's work*.

Heslin (2005, p. 118) claims that an important factor in appraising success is who we compare ourselves with. Someone may appraise their career based on their own criteria, but also based on the achievements and aspirations of others. Personal criteria include resolutions concerning earning a particular amount by a certain age. In this case, the individual does not compare themselves to others, instead follows their own plan and assesses whether they are moving closer to achieving their goal. However, it is more frequently the case that individuals compare themselves to others. In such cases, their appraisal of success depends on the achievements of others and the results of comparisons.

Another important factor of career success is the opinion of immediate family members. For example, if a young individual continues family traditions regarding their choice of profession, it may constitute social learning and adopting of other people's expectations as their own indicators of success. It is also worth noting that many magazines and television programs present career success as synonymous with wealth. From this perspective, all appraisals of career success must be based on comparisons with others. Heslin (2003) studied the criteria based on which MBA students appraise their career success. The study participants were asked to appraise their career success and provide a justification for their appraisal. A total of 68% of the respondents compared themselves with others, citing reasons such as: *my pay is relatively high compared to my peers or people younger than me have advanced further in their careers than me*.

Professional success as defined by economics students

A questionnaire study was conducted among students of the Poznań University of Economics in 2018, the purpose being to determine what the students consider as career success. A total of 267 students participated in the study, including 53.3% women and 46.7% men. The average age was 21. The participants were asked to write several sentences on what they believed constituted career success. Their responses were grouped into categories and are presented in Table 2.

The participants most frequently defined career success as having a satisfying job which paid well. In second place was achieving professional goals and self-fulfillment at work, and in third place was achieving growth and good pay. It is important to note that the majority of the participants focused on two aspects of career success, and only a small portion listed only one factor, e.g. *satisfaction* (5.1%). This stems from the fact that career success is difficult to define in terms of a single feature – a minimum of two aspects must be taken into account when defining it.

It is also worth noting that the most popular answer, *satisfaction and good pay*, consisted of both a subjective (satisfaction) and an objective (pay) aspect. It thus appears that analyses of career success should focus primarily on these two aspects, which is the sense of satisfaction with one's work and pay. Also interesting is the fact that, in this study, work-life balance proved to be of lesser importance, even though it was the most important factor in other studies. Having a satisfying job and a work-life balance constituted career success for only 4.1% of all

Table 2. Most frequent definitions of professional success provided by PUE students

No.	What is professional success?	Percentage
1.	Satisfaction and good income	33.0
2.	Achieving goals, self-fulfillment	15.2
3.	Growth and income	6.5
4.	Satisfaction	5.1
5.	Satisfaction and balance	4.0

Source: author's own work.

participants. The reason for this may be that they were all young individuals, most of whom were yet to start families.

Summary

In conclusion, individuals frequently define career success in subjective terms which elude the objective indicators used in the relevant literature. It is thus important to remember that objective aspects (e.g. pay and promotions) do not constitute accurate indicators of career success. Moreover, job and career satisfaction may be insufficient to represent the broad spectrum of factors which influence one's subjective appraisal of career success. Individuals appraise their career success based on various factors which extend beyond the typical indicators. Januszkiewicz (2012) correctly claims that being success-oriented has become natural in the modern world, and that it is commonly believed that success can be achieved by every employee. Individuals decide what career success is to them, as well as where and when they want to achieve it (Cybal-Michalska, 2013). Everyone can achieve success in line with their own definition. For some, success is being promoted, for others it is experience or independence. In light of the above, organizations may find traditional incentive tools to be increasingly ineffective.

The results of the study conducted among economics students indicate that young people consider job satisfaction, the ability to develop and self-fulfillment at work to be extremely important. Pay is still a very important objective factor, though it was the only objective aspect listed by the participants. This implies that what motivates young people most is finding a job which offers them satisfaction and opportunities to achieve their personal professional goals. Managers should take into account the changing perceptions of career success and adapt the incentive tools used by their companies accordingly. It is a valid claim that job satisfaction and development opportunities are currently more important than promotions or prestige.

This article was an attempt to answer the question of what constitutes career success in the modern world. The results indicate that the term is exceptionally difficult to define, and that modern definitions of career success differ from those used in the past. What is more, the term is frequently used in common parlance, and its inherent subjectivity means that its construal may continue to change. All this necessitates that analyses of career success take into account various perspectives and include both objective and subjective factors. Only thus is it possible to assume with certainty that we are actually studying career success and not just its constituent indicators, such as pay and job satisfaction.

References

- Arthur, M.B., Khapova, S.N., & Wilderom, C.P.M. (2005). Career success in a boundaryless career world. *Journal of Organizational Behavior*, 26(2), 177–202. DOI: <https://doi.org/10.1002/job.290>
- Aryee, S., Chay, Y.W., & Tan, H.H. (1994). An Examination of the Antecedents of Subjective Career Success Among a Managerial Sample in Singapore. *Human Relations*, 47(5), 487–509. DOI: <https://doi.org/10.1177/001872679404700502>
- Bohdziewicz, P. (2008). *Kariery zawodowe w gospodarce opartej na wiedzy*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.
- Byłok, F. (2005). Wzór sukcesu w społeczeństwie polskim w okresie transformacji społeczno-ustrojowej. *Annales. Etyka w Życiu Gospodarczym*, 8(1), 87–96.
- Cesarz-Kwietniak, N., & Sawicka, M. (2013). *Czym dla menedżerów jest sukces?* Retrieved from <https://www.hbr.org/pl/a/czym-dla-menedzerow-jest-sukces/10K1FJiyN>
- Cybal-Michalska, A. (2013). Świat w którym „kariera robi karierę” – o satysfakcji z kariery i poczuciu zawodowego sukcesu. *Studia Edukacyjne*, 26, 19–38.
- Czapiński, J., & Panek, T. (2015). *Diagnoza Społeczna 2015*. Retrieved from www.diagnoza.com
- Firkowska-Mankiewicz, A. (1999). *Zdolnym być... Kariery i sukces życiowy warszawskich trzydziestolatków*. Warszawa: IFiS PAN.
- Friedman, S.D., & Greenhaus, J.H. (2000). *Work and family – allies or enemies?* New York: Oxford University Press.
- Ganiron, T.U. (2013). Social Capital and Career Success of Civil Engineers towards Designing Career Paths. *Procedia – Social and Behavioral Sciences*, 102, 611–621. DOI: <https://doi.org/10.1016/j.sbspro.2013.10.778>
- Greenhaus, J.H., Parasuraman, S., & Wormley, W.M. (1990). Effects of Race on Organizational Experiences, Job Performance Evaluations, and Career Outcomes. *Academy of Management Journal*, 33(1), 64–86.
- Gunz, H., & Heslin, P.A. (2005). Reconceptualizing career success. *Journal of Organizational Behavior*, 26(2), 105–111. DOI: <https://doi.org/10.1002/job.300>
- Gunz, H., & Mayrhofer, W. (2011). Re-conceptualizing career success: a contextual approach. *Zeitschrift Für Arbeitsmarkt Forschung*, 43(3), 251–260. DOI: <https://doi.org/10.1007/s12651-010-0049-z>
- Heslin, P.A. (2003). Self- and Other-Referent Criteria of Career Success. *Journal of Career Assessment*, 11(3), 262–286. DOI: <https://doi.org/10.1177/1069072703254500>
- Heslin, P.A. (2005). Conceptualizing and evaluating career success. *Journal of Organizational Behavior*, 26(2), 113–136. DOI: <https://doi.org/10.1002/job.270>
- Januszkiewicz, K. (2012). Sukces zawodowy w percepcji pokolenia Y. *Studia Ekonomiczne Regionu Łódzkiego*, 8, 351–362.
- Judge, T.A., Cable, D.M., Boudreau, J.W., & Bretz, R.D. (1995). An Empirical Investigation of the Predictors of Executive Career Success. *Personnel Psychology*, 48(3), 485–519. DOI: <https://doi.org/10.1111/j.1744-6570.1995.tb01767.x>
- Kawka, T. (2014). *Wynagrodzenia w organizacjach nowej gospodarki*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
- Locke, E.A. (1976). The nature and causes of job satisfaction. In M.D. Dunnette (Ed.) *Handbook of industrial and organizational psychology* (pp. 1297–1343). Chicago: Rand McNally.
- Młodawska, E. (2015). *Czym jest i od czego zależy sukces zawodowy?* Retrieved from <http://www.psychologia.net.pl/artykul.php?level=748>
- Poole, M.E., Langan-Fox, J., & Omodei, M. (1993). Contrasting subjective and objective criteria as determi-

nants of perceived career success: A longitudinal study. *Journal of Occupational and Organizational Psychology*, 66(1), 39–54. DOI: <https://doi.org/10.1111/j.2044-8325.1993.tb00515.x>

Schomburg, H. (2007). The professional success of higher education graduates. *European Journal of Education*, 42(1), 35–57. DOI: <https://doi.org/10.1111/j.1465-3435.2007.00286.x>

Seibert, S.E., Kraimer, M.L., & Liden, R.C. (2001). A Social Capital Theory of Career Success. *Academy of Management*, 44(2), 219–237. DOI: <http://dx.doi.org/10.2307/3069452>

Sobol, E. (2005). *Słownik języka polskiego*. Warszawa: PWN.

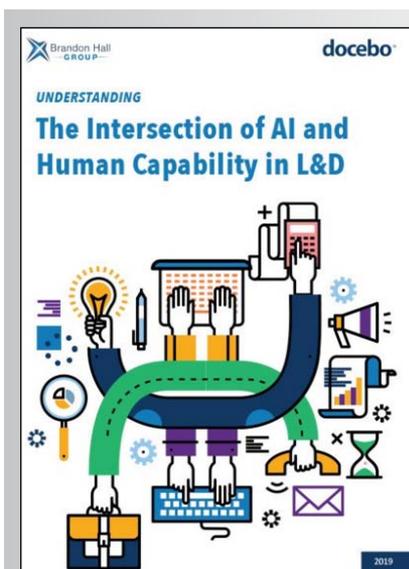
Sowińska, A. (2014). Zadolenie z pracy – problemy definicyjne. *Studia Ekonomiczne*, 197, 45–56.

Abstract

This article constitutes an attempt to determine the modern meaning of career success. Over the recent years, its perception has undergone changes, with subjective indicators such as job satisfaction and achievement of one's own professional goals growing in importance. The present article reviews the relevant literature and presents the results of the author's own study on the meaning of career success conducted among students of economics. The results indicate that career success is defined subjectively in the modern world and is no longer confined to the objective indicators commonly applied in literature. Thus, organizations may find traditional incentive tools to be increasingly ineffective.

Keywords: career success, job satisfaction, salary, compensation

Adam Metelski is a Doctor of Economics and Assistant Lecturer at the Poznan University of Economics. His research interests include career success, sports and motivation to work.



WE RECOMMEND

Understanding the Intersection of AI and Human Capability in L&D

The world is more chaotic and complex than ever but learning technology has the potential to mitigate this complexity by augmenting our intelligence and equipping people with the skills they need to adapt and evolve. We should emphasize the importance of understanding the relationship between artificial intelligence and human beings. The best results are achieved by people and machines working in tandem.

It is also important to understand what AI is and what it isn't. Most of what we encounter today is really machine learning, where software uses algorithms to learn and recognize patterns. These algorithms are derived from deep learning, where software is designed like the neural network of the brain to absorb and interpret data.

These changes require the L&D function to change, as well. Far from AI taking jobs away, it is creating new needs and opportunities that companies must be ready to face. This means a new focus on the types of tools

used to create and deliver learning, as well as what it takes to lead learning into the future.

Publisher: Brandon Hall Group, 2019. Licensed for distribution by Docebo.

More information at <https://elearningindustry.com/free-ebooks/artificial-intelligence-and-human-capability-in-ld>



Competition Mechanisms in the Sharing Economy

Małgorzata Godlewska*

The article is based on the results of the statutory study "Competition mechanisms in the 21st century", conducted under the supervision of Professor Jerzy Pietrewicz. The study was conducted by the author in 2018 at the Collegium of Business Administration of the Warsaw School of Economics. The purpose of this article was to identify the competition mechanisms utilized by the leading online platforms operating within the sharing economy based on a number of case studies (20 cases).

In recent years, the sharing economy has experienced rapid growth around the globe in terms of the number of participants and transactions, as well as profits. This has become possible due to the proliferation of the internet across the globe (Ericsson, 2015). The total value of transactions conducted in 2015 by EU member states ('EU') via online platforms in the main sectors of the sharing economy exceeded EUR 28 billion (European Parliament, 2017a).

Many experts, including Botsman and Rogers (2010), Allen and Berg (2014) and Sundararajan (2016), as well as institutions such as the European Parliament (2017b) and the European Commission (EC, 2016), claim that the sharing economy offers new possibilities in terms of: 1) growing entrepreneurship, 2) reducing operating costs, 3) creating new jobs, 4) increasing the effectiveness of economic systems, 5) more optimal resource and asset allocation, 6) increasing the competitiveness of many sectors of the economy, and 7) contributing to consumer prosperity. It is also important to note that, according to the European Parliament (2017b), the sharing economy is beneficial to EU society, even despite the challenges it poses to many traditional economic models. On the other hand, experts such as Slee (2015) and Toroń and Wiese (2017) note that the largest online platforms, such as UberX and Airbnb,¹ operate outside local and domestic legal frameworks.

Moreover, the relevant literature poses questions regarding the economic and social implications of the sharing economy (Pietrewicz and Sobiecki, 2017, pp. 11–12) and the possibility of a paradigm shift from market capitalism to collaborative commons (Rifkin, 2016, pp. 9–35). In order to answer the above questions it is first necessary to determine the competition mechanisms utilized in the sharing economy. The purpose of this article was to identify the competition mechanisms utilized by online platforms operating within the sharing economy. Case studies were conducted for 20 leading online platforms operating in the main sectors of the sharing economy (e.g. transportation, tourism, finance, catering, education, leisure, animal care), which rendered it possible to identify five different competition mechanisms, ranging from aggressive, profit and advantage-oriented competitive pricing to pro-social, non-price competition based on non-profit activities, as well as acquiring a social and epistemic advantage.²

The essence of the sharing economy

The sharing economy became the center of attention between 2011 and 2012 due to the success of two online platforms: Uber and Airbnb (Martin, 2016). The dynamic growth of the sharing economy which has taken place in the last 10 years, experts claim, has been caused by a change in the attitudes of consumers: 1) from the need to possess assets to the need to access them (Pietrewicz and Sobiecki, 2017), 2) from preferring full-time employment to flexible forms of work (Woskko, 2014), 3) from private consumption to sharing what we possess with others (Belk, 2007), 4) from polluting the environment to reducing our environmental footprint (Schor, 2014), and 5) from extensive economic growth to sustained development (Heinrichs, 2013). Moreover, the neoclassical

* SGH Warsaw School of Economics, Poland

¹ The relevant literature is divided on whether UberX and Airbnb are part of the sharing economy (see also Slee, 2015; Meelen and Frenken, 2015; Sundararajan, 2016).

² The study of the competition methods used by online platforms utilized a methodology as presented in Konecki, 2018; Corbin and Strauss, 1990; Glaser and Strauss, 1967.

economic theory of sharing uses the example of club goods to emphasize that the sharing of private goods ceases the moment the costs of sharing such goods with another person exceed the benefits of sharing these costs (Buchanan, 1965, p. 5).

It is worth noting that the first attempt at defining the term *sharing economy* was made by Lessig (2008), who claimed that it constituted consumption via sharing, exchanging and lending one's own resources without transferring ownership rights. Botsman (2015) notes that the sharing economy should be understood to only encompass online platforms with clear values, operating based on transparent rules, which value and respect their users and offer them access to assets, not ownership of them, under more beneficial conditions compared to the traditional model. Frenken and Schor (2017) emphasize that the key aspect of the sharing economy is the less risky use of unallocated resources via sharing with strangers who can be rated.

The relevant literature (Slee, 2015; Einav, Faronato and Levin, 2015; Sundararajan, 2016) lists the following features shared by online platforms in the sharing economy, including Airbnb, UberX, EatWith, TaskRabbit and Getaround: 1) the ability to create new markets and challenge the leaders of the traditional economy, e.g. UberX challenging taxi corporations; 2) operating on two-sided markets, e.g. Airbnb is successful due to attracting a large number of both hosts (i.e. service providers) and guests, i.e. service beneficiaries; 3) utilizing network effects – e.g. dog owners (service beneficiaries) using Rover benefit from the increasing number of new dog walkers (service providers); 4) reaching users with the use of digital technologies, e.g. Getaround uses an application to find and open unused cars in the area; 5) use of mechanisms which match transaction parties, e.g. BlaBlaCar uses adverts posted on its online platform; 6) use of rating systems, e.g. TaskRabbit awards a special status to users with the highest ratings and who are the most active on the platform; and 7) cornering new markets, frequently by circumventing regulatory barriers.

It is worth noting that the sharing economy is primarily targeted at millennials living in urban areas who use the latest technologies, leaving the older generations and those living in rural areas outside its boundaries and sphere of influence (Wagner et al., 2015). Moreover, research conducted by the Center for a New American Dream (CNAD) demonstrates that 72% of all Americans participating in the sharing economy are motivated by purely financial reasons, not social ones (Fremstad, 2018). Mikołajewska-Zajac and Rodak (2016, p. 68) underline that this “commodification of the sharing economy” may constitute the next stage of development of the market economy.

Competition mechanisms in the sharing economy

Effective competition mechanisms are crucial to global economic development (Śliwińska, 2013). Companies operating as part of the sharing economy compete with traditional market actors by using online-based business models. Online platforms provide the technologies necessary for transactions to take place between individual users (peer-to-peer, 'P2P') or businesses and individual users (business-to-peer, 'B2P'). Sharing economy entities compete in what are known as two-sided markets, and, in order to achieve success, they must acquire both service providers and recipients (Rochet and Tirole, 2003). Moreover, two-sided markets are characterized by the ability to expand rapidly and economies of scale (Demary, 2015). In addition, due to the network effect, the value of a service increases with the number of users, constituting a barrier to entry, which has affected certain Polish online platforms such as Wulu.pl, InOneCar.com and JadeZabioire.pl. The largest online platforms in the sharing economy profit from commissions charged for acting as an intermediary in transactions between service providers and recipients. Platforms such as Uber, Lyft, Getaround and Zipcar compete against one another and traditional market actors, striving to achieve analogous or similar goals, on occasion preventing their competitors from achieving their established targets.³

The competition mechanisms used by online platforms in the sharing economy are to a large degree determined by their market orientation and structure (Schor, 2014). An online platform may be profit-oriented or non-profit. The market structure adopted by the online platforms of the sharing economy is based on exchanges, leasing or sharing between participants (P2P) and/or exchanges between businesses and individual participants (B2P).

What is more, the credibility of an online platform and its users, as well as whether it possesses a relative competitive advantage (Kim, Yoon and Zo, 2015) are also significant factors determining the competition mechanisms. The credibility of an online platform and its users can be built upon: 1) reputation via a rating system, e.g. Getaround; 2) free insurance, e.g. TaskRabbit and Airbnb; 3) social media presence (Facebook, Twitter, etc.), e.g. JustPark; and 4) posting comments, e.g. Airbnb. Moreover, rating systems used by online platforms, where ratings are based on comments and being active on the platform, are supposed to indicate the “digital quality” of platform users. Nonetheless, the European Parliament (2017a and 2017b) notes that online platforms may apply unfair and arbitrary practices with regard to publishing ratings and compiling user rankings based on those ratings. It should also be noted that a relative competitive advantage may

³ Competition as defined in Stankiewicz (2005, p. 18).

Competition Mechanisms in the Sharing Economy

be achieved by online platforms based on the following benefits (Kim, Yoon and Zo, 2015): 1) economic benefits, e.g. rendering less expensive services than traditional businesses; 2) social benefits, e.g. potential new relationships; and 3) epistemic benefits, e.g. acquiring new experiences.

The analysis of 20 leading sharing economy platforms operating in the transportation, tourism, finance, catering, education, leisure and animal care sectors (see Table 1) identified the following competition mechanisms:

1. Aggressive price-based competition with ratings

Online platforms which utilize an aggressive price-based competition mechanism with ratings base their exclusively for-profit activities on offering an economic advantage. They compete with prices against one another and against traditional market actors. Transactions on such platforms occur between individual users (P2P). In addition, service providers on such platforms are rigorously assessed and rated by service recipients and the platform itself. Certain platforms (e.g. UberX) prevent service providers from creating their own pricing policies or selecting their “customers” (recipients) by use of sanctions (e.g. banning) for the “excessive” rejecting of jobs assigned by the platform. This mechanism is utilized by transportation platforms such as JustPark, UberX and Lyft.

2. Aggressive price-based competition without ratings

Online platforms utilizing this mechanism operate based on a strict for-profit model. In addition, they utilize economic and social advantages, competing with prices among themselves and against traditional market entities. Transactions on such platforms occur between businesses and individual users (B2P). Service providers on such platforms (businesses) are not rigor-

ously assessed or rated by service recipients, as opposed to the rating model. This mechanism is utilized by food and grocery delivery, as well as office sharing platforms such as Postmates, WeWork and Instacart.

3. Moderate price-based competition

Online platforms utilizing the moderate price-based competition mechanism use both economic and non-economic (social and epistemic) advantages. They operate strictly for profit, but also undertake additional activities to enable their users to (at least in theory) meet new people and acquire new experiences. Such platforms compete with prices among themselves and against traditional market entities. Transactions occur between individual users (P2P). In addition, it is the service providers who are most frequently rated on platforms utilizing the above mechanism. This model is used by platforms offering meal and car sharing services such as EatWith and BlaBlaCar, as well as platforms acting as intermediaries in task delegation such as TaskRabbit and Handy.

4. Price-based competition with moderate non-price competition

Online platforms utilizing this combination of competition mechanisms operate based on an economic advantage and are strictly profit-oriented. They compete among each other and against traditional market actors using pricing and non-price factors, e.g. the experience and reputation of their service providers. Transactions on such platforms occur primarily between individual users (P2P). In addition, both the recipients and providers are assessed and rated. This model is utilized by platforms which offer car and sports equipment rental services such as Getaround and Spinlister, as well as platforms which act as intermediaries in renting out rooms and providing animal care services, such as Airbnb and Rover.

Table 1. Competition mechanisms utilized by online platforms operating within the sharing economy

Name of online platform	Service	Competition mechanism (CM)*	Type CM**	Market structure	Market orientation***	Rating system****	Relative advantage*****
JustPark	Renting of parking spots	PC	Aggressive PC with ratings	P2P	FP	P	E
UberX and uberPOOL	Sharing of means of transport	PC	Aggressive PC with ratings	P2P	FP	P	E
Lyft or Shared	Sharing of means of transport	PC	Aggressive PC with ratings	P2P	FP	P	E
Postmates	Package delivery, e.g. food, groceries	PC	Aggressive PC without ratings	B2P	FP	None	E and S
WeWork	Office space sharing	PC	Aggressive PC without ratings	B2P	FP	None	E and S

Table 1 – cont.

Name of online platform	Service	Competition mechanism (CM)*	Type CM**	Market structure	Market orientation***	Rating system****	Relative advantage*****
Rent the Runway	Renting out clothes and accessories	PC	Aggressive PC without ratings	B2P	FP	None	E
Instacart	Grocery deliveries	PC	Aggressive PC without ratings	B2P	FP	None	E and S
TaskRabbit	Assigning tasks	PC	Moderate PC	P2P	FP	P	E and S
Handy	Assigning tasks	PC	Moderate PC	P2P	FP	P	E and S
EatWith	Meal sharing	PC	Moderate PC	P2P	FP	P	EP, E and S
BlaBlaCar	Car sharing	PC	Moderate PC	P2P	FP	R and P	E and S
Favor	Food deliveries	PC	Moderate PC	P2P	FP	None	E and S
Getaround	Renting out unused cars	PC, NC	PC, moderate NC	P2P	FP	R and P	E
Spinlister	Renting out high-end sports equipment	PC, NC	PC, moderate NC	P2P	FP	R and P	E
Airbnb	Renting out unoccupied rooms, apartments and houses	PC, NC	PC, moderate NC	P2P, B2P	FP	R and P	E and S
Rover (DogVacay)	Looking after dogs and cats	PC, NC	PC, moderate NC	P2P	FP	P	E
Coursera	E-learning courses and specializations, post-graduate programs	PC, NC	PC, moderate NC	B2P	FP	None	E
Kiva	Loans of between USD 25 and 700 for new businesses in developing countries	NC	Pro-society NC	P2P	NP	R	E and S
Streetbank	Sharing tools with neighbors	NC	Pro-society NC	P2P	NP	None	E and S
Couchsurfing	Couch sharing	NC	Pro-society NC	P2P	FP	R and P	EP, E and S

* Price competition (PC) and non-price competition (NC).

** Price competition (PC) and non-price competition (NC).

*** For-profit (FP) and Non-profit (NP).

**** Recipients (R) and Providers (P).

***** Economic advantage (E), e.g. participating in costs, additional income or flexible terms of employment; Social advantage (S), e.g. meeting new people; Epistemic advantage (EP), e.g. new experiences.

Source: author's own work based on 20 case studies of the largest online platforms in the sharing economy.

5. Pro-society, non-price competition

Online platforms utilizing the pro-society, non-price competition mechanism do not operate for profit, and focus primarily on non-economic advantages. They do not compete using prices against one another or traditional market actors. Transactions on such platforms occur between individual users (P2P). In addition, it is the recipients who are most frequently rated. This model is utilized by platforms which focus on non-profit activities, such as Kiva and Streetbank.

The sharing economy allows both online platforms and users to apply various competition mechanisms. Despite the promises by the largest sharing economy platforms regarding applying social economy principles or ensuring a fair distribution of profits, price-based competition is pervasive in practice. Service providers on those platforms compete for customers (service recipients) primarily using pricing, not quality or experience. Only platforms such as Kiva, Streetbank and Couchsurfing do not force their service providers to apply price-based competition mechanisms. A possible explanation is that these platforms do not operate for profit (with the exception of Couchsurfing⁴). Many researchers believe that the price-based competition occurring between service providers on online platforms may lead to the formation of a new form of precariat (Standing, 2011). Moreover, research conducted by Slee (2015) and Zervas, Proserpio and Byers (2015), for example, confirms that the rating systems used by online platforms are inflated and inaccurate, as more than 98% of all service providers on platforms such as Airbnb, Handy (Homejoy) and TaskRabbit are rated higher than 4.7 (out of 5). Thus, service providers, instead of utilizing non-price competition mechanisms based on reputation, are forced to compete using prices. In addition, online platforms in the sharing economy do not allow users to transfer ratings between them, their stated reasons being that having a high rating as an Airbnb host, for example, is not comparable to a different activity, e.g. being an Uber driver. Nevertheless, users of online platforms such as Airbnb, Rover (DogVacay) and Getaround use non-price mechanisms in addition to price competition, emphasizing their experience or offering additional services. In addition, a case study on Airbnb has demonstrated that an “appropriate” photo of the host has an impact on the popularity of what they offer and whether or not they can demand a higher rate (Ert, Fleischer and Magen, 2016).

Summary

Online platforms operating in the sharing economy use various competition mechanisms, from aggressive, profit and economic advantage-oriented, price-based methods to pro-society, non-price mechanisms based on non-profit activities and social and epistemic advantages.

Nevertheless, in practice, users are frequently “forced” by online platforms to aggressively compete for customers using pricing. This happens especially in situations where both the prices and the processes of matching providers with customers are regulated in a top-down fashion by the platform. Online platforms such as Uber, Postmates and Instacart offer service providers no freedom in terms of decision-making.

Moreover, online platforms, by way of using inflated and hardly credible ratings (Slee, 2015), prevent users from applying non-price, reputation-based competition mechanisms. This phenomenon may lead to the formation of a new form of precariat (Standing, 2011). Nevertheless, users of online platforms such as Airbnb, Rover (DogVacay) and Getaround use non-price mechanisms in addition to price competition, emphasizing their experience or offering additional services. In addition, platforms such as Kiva and Streetbank, which are non-profit in nature, allow their users to use non-price mechanisms.

It is worth noting that, according to numerous researchers (e.g. Scott and Edda, 2014; Slee, 2015; Frenken and Schor, 2017), online platforms operating as part of the sharing economy frequently resort to unfair practices, as unlike traditional market actors, many regulations do not apply to them, enabling such companies to avoid certain costs by transferring them and their related risks to service providers, i.e. the users of these platforms, the majority of whom are natural persons (microenterprises).

References

- Allen, D., & Berg, C. (2014). *The sharing economy. How over-regulation could destroy an economic revolution*. Retrieved from <https://collaborativeconomy.com/wp/wp-content/uploads/2015/04/Allen-D.-and-Berg-C.2014.The-Sharing-Economy.-Institute-of-Public-Affairs.-.pdf>
- Belk, R. (2007). Why not share rather than own? *Annals of the American Academy of Political and Social Science*, 611, 126–140. DOI: 10.1177/0002716206298483
- Botsman, R. (2015). *Defining The Sharing Economy: What Is Collaborative Consumption—And What Isn't?*. Retrieved from <https://www.fastcompany.com/3046119/defining-the-sharing-economy-what-is-collaborative-consumption-and-what-isnt>
- Botsman, R., & Rogers, R. (2010). *What's Mine Is Yours: The Rise of Collaborative Consumption*. Harper Business Kindle Edition.
- Buchanan, J. (1965). An economic theory of clubs. *Economica*, 32(125), 1–14.
- Burgiel, A. (2015). Determinanty i perspektywy upowszechnienia konsumpcji wspólnej w Polsce. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, 231, 7–29.
- Corbin, J., & Strauss, A. (1990). Grounded Theory Research: Procedures, Canons and Evaluative Criteria. *Qualitative Sociology*, 13(1), 3–21.

⁴ Couchsurfing is a platform where hosts make their couches available for free to guests of their choosing.

- Demary, V. (2015). *Competition in the Sharing Economy*. Retrieved from https://www.iwkoeln.de/fileadmin/publikationen/2015/235445/Sharing_Economy_Policy_Paper.pdf
- Einav, L., Faronato, C., & Levin, J. (2015). Peer-to-Peer Markets. *Annual Review of Economics*, 8, 615–635. DOI: 10.1146/annurev-economics-080315-015334
- Ericsson. (2015). *Ericsson Mobility Report on the pulse of the networked society*. Retrieved from <https://www.ericsson.com/assets/local/news/2015/6/ericsson-mobility-report-june-2015.pdf>
- Ert, E., Fleischer A., & Magen, N. (2016). Trust and reputation in the sharing economy: The role of personal photos in Airbnb. *Tourism Management*, 55, 62–73. DOI: 10.1016/j.tourman.2016.01.013
- European Commission. (2016). *Komunikat Komisji do Parlamentu Europejskiego, Rady, Europejskiego Komitetu Ekonomiczno-Społecznego i Komitetu Regionów: Europejski program na rzecz gospodarki dzielenia się*. Retrieved from <https://ec.europa.eu/docsroom/documents/16881/attachments/2/translations/pl/renditions/native+&cd=1&hl=pl&ct=clnk&gl=pl>
- European Commission. (2018). *Common position of national authorities within the CPC Network on the commercial practices and the terms of service of Airbnb Ireland*. Retrieved from https://ec.europa.eu/info/sites/info/files/final_common_position_on_airbnb_ireland_4.6.2018_en_002.pdf
- European Parliament. (2017a). *Gospodarka dzielenia się: Posłowie chcą unijnej strategii*. Retrieved from <http://www.europarl.europa.eu/news/pl/headlines/economy/20170428STO72971/gospodarka-dzielenia-sie-poslowie-chca-unijnej-strategii>
- European Parliament. (2017b). *Rezolucja Parlamentu Europejskiego z dnia 15 czerwca 2017 r. w sprawie europejskiego programu na rzecz gospodarki dzielenia się*. Retrieved from <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2017-0271+0+DOC+XML+V0//PL>
- Fremstad, A. (2018). Is there a future for sharing? A comparison of traditional and new intuitions. *Journal of Institutional Economics*, 14(4), 595–616. DOI: 10.1017/S1744137417000297
- Frenken, K., & Schor, J. (2017). Putting the sharing economy into perspective. *Environmental Innovation and Societal Transitions*, 23, 3–10. DOI: 10.1016/j.eist.2017.01.003
- Glaser, B., & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Mill Valley, CA: Sociology Press.
- Heinrichs, H. (2013). Sharing Economy: A Potential New Pathway to Sustainability. *Gaia – Ecological Perspectives for Science and Society*, 22(4), 228–231.
- Kim, J., Yoon, Y., & Zo, H. (2015). Why people participate in the Sharing Economy: A Social Exchange Perspective. *Journal of the Association for Information Science and Technology*, 67(9), 2047–2059. DOI: 10.1002/asi.23552
- Konecki, K.T. (2018). *Studia z metodologii badań jakościowych. Teoria ugruntowana*. Warszawa: Wydawnictwo Naukowe PWN.
- Lessig, L. (2008). *Remix: Making art and commerce thrive in the hybrid economy*. New York: Penguin.
- Martin, C.J. (2016). The sharing economy: A pathway to sustainability or a nightmarish from neoliberal capitalism? *Ecological Economics*, 121, 149–159. DOI: 10.1016/j.ecolecon.2015.11.027
- Meelen, T., & Frenken, K. (2015). *Stop Saying Uber is Part of the Sharing Economy. What is being shared besides your money?* Retrieved from <https://www.fastcompany.com/3040863/stop-saying-uber-is-part-of-the-sharing-economy>.
- Mikołajewska-Zajac, K., & Rodak, O. (2016). Platformy współdzielcze jako próba rewizji korporacyjnego modelu gospodarki współdzielonej. *e-mentor*, 4(66), 67–73. DOI: 10.15219/em66.1265
- Pietrewicz, J.W., & Sobiecki, R. (2017). Przedsiębiorczość Sharing Economy. In M. Poniatowska-Jaksch, & R. Sobiecki (Eds.). *Sharing Economy (gospodarka współdzielenia)* (pp. 11–26). Warszawa: Oficyna Wydawnicza SGH.
- Poniatowska-Jaksch, M., & Sobiecki, R. (Eds.). (2017). *Sharing Economy (gospodarka współdzielenia)*. Warszawa: Oficyna Wydawnicza SGH.
- Rifkin, J. (2016). *Spółczesność zerowych kosztów transakcyjnych. Internet przedmiotów, Ekonomia współdzielenia, Zmierzch kapitalizmu*. Warszawa: Wydawnictwo Studio Emka.
- Rochet, J.-C., & Tirole, J. (2003). Platform Competition in Two-sided Markets. *Journal of the European Economic Association*, 1(4), 990–1029. DOI: <https://doi.org/10.1162/154247603322493212>
- Schor, J. (2014). *Debating the Sharing Economy*. Retrieved from <https://www.greattransition.org/publication/debating-the-sharing-economy>
- Scott, M., & Eddy, M. (2014). *Uber Service Banned Across Germany by Frankfurt Court*. Retrieved from http://bits.blogs.nytimes.com/2014/09/02/uber-banned-across-germany-by-frankfurt-court/?_php=true&_type=blogs&emc=eta1&r=0
- Slee, T. (2015). *What's yours is mine. Against the Sharing Economy*. New York, London: OR Books.
- Śliwińska, M. (2013). Ochrona konkurencji we współczesnej gospodarce wyzwaniem dla teorii konkurencji. *Ekonomia i Prawo*, 13(2), 207–219. DOI: 10.12775/EiP.2013.016
- Standing, G. (2011). *The precariat*. London: Bloomsbury Academic.
- Stankiewicz, M.J. (2005). *Konkurencyjność przedsiębiorstwa. Budowanie konkurencyjności przedsiębiorstwa w warunkach globalizacji*. Toruń: TNOiK.
- Sundararajan, A. (2016). *The sharing economy. The end of employment and the rise of crowd-based capitalism*. Cambridge, Massachusetts, London: The MIT Press.
- Toroń, M., & Wiese, K. (2017). Aplikacja UBER lub jak ująć sharing economy w istniejące ramy prawne. *Internetowy Kwartalnik Antymonopolowy i Regulacyjny*, 5(6), 8–27. DOI: 10.7172/2299-5749.IKAR.5.6.1
- Wagner, T., Kuhndt, M., Lagomarsino, J., & Matzar, H. (2015). *Listening to Sharing Economy Initiatives*. Retrieved from https://www.scp-centre.org/wp-content/uploads/2016/05/Listening_to_Sharing_Economy_Initiatives.pdf
- Woskko, D. (2014). *Unlocking the sharing economy. An independent review*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/378291/bis-14-1227-unlocking-the-sharing-economy-an-independent-review.pdf
- Zervas, G., Proserpio, D., & Byers, J. (2015). *A First Look at Online Reputation on Airbnb, Where Every Stay Is Above Average*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2554500

Competition Mechanisms in the Sharing Economy

Abstract

In recent years, the sharing economy has experienced rapid growth across the globe in terms of the number of participants and transactions, as well as profits. Experts claim that the sharing economy offers new possibilities for entrepreneurship, reducing operating costs, creating new jobs, increasing the effectiveness of economic systems, giving better allocation of resources and assets, as well as increasing the competitiveness of numerous sectors and the quality of life for consumers.

The purpose of this article is to study the competition mechanisms utilized by online platforms operating in the sharing economy. Case studies were conducted on 20 leading online platforms operating in the main sectors of the sharing economy (e.g. transportation, tourism, finance, catering, education, leisure, animal care), which rendered it possible to identify 5 different competition mechanisms, ranging from aggressive, profit and economic advantage-oriented competitive pricing to pro-social, non-price competition based on non-profit activities, as well as offering social and epistemic advantage.

The main actors in the sharing economy apply various price and non-price competition mechanisms. Nevertheless, in practice, users are frequently “forced” by online platforms to compete for customers using pricing. This happens especially in situations where both the prices and the process of matching providers with recipients are regulated top-down by the platform. Online platforms frequently offer service providers no freedom in terms of decision-making. Moreover, online platforms, by using inflated and hardly credible ratings, render users unable to use non-price, reputation-based competition mechanisms, which, experts claim, may lead to the creation of a new form of precariat.

Keywords: sharing economy, competition mechanisms, two-sided markets, P2P, internet platforms

Małgorzata Godlewska is a Doctor of Economics and Adjunct at the SGH Warsaw School of Economics. She has been researching competition mechanisms, including in e-commerce, for the past six years. Her research interests include knowledge-based economic growth assisted by artificial intelligence, as well as the impact of the sharing economy on the competitiveness of EU member states.

WE RECOMMEND



Devco Academy

The DEVCO Academy, launched in April 2018 by a partnership of diverse entities such as the World Food Programme (WFP), the World Bank and different national governments, is a public information and education platform aiming at providing expertise to improve the skills of citizens interested in development and international cooperation.

This portal offers over 120 free online courses on 18 relevant and different topics, including agriculture, budget support, food security, gender, disability, and trade, all of which are taught through podcasts, online classes, *webinars* and other innovative learning methods and resources.

DEVCO Academy invites the international community to learn about its most recent courses, upcoming events and to promote policy coherence and learning. All Academy content is free to use.

More information at <https://webgate.ec.europa.eu/devco-academy/>



Celina
Sołek-Borowska*

Barriers to Knowledge Sharing for Prosumers and Global Team Employees



Monika
Eisenhardt**

Knowledge-based companies, which are the foundation of the knowledge economy, must seek innovations, ideas and knowledge both inside and outside the company. This means that they must build their business on knowledge which may be found inside and outside the company. The knowledge of the employees, which comprises the internal knowledge of the company, is embedded in the business reality but is created by a limited number of people who are often used to thinking in a specific way or one imposed by the managers. On the other hand, the knowledge of the consumers is created outside the company, and thereby forms an external source of knowledge. That knowledge is created by numerous people who are not constrained by the internal regulations or rules of the company. Modern companies must gather the knowledge of their employees and consumers, which means they must create good conditions for knowledge sharing. Consumers and employees can share knowledge seamlessly, but very often they are reluctant to do so even if suitable conditions are developed. The challenge for businesses is to find and overcome the barriers that discourage their prosumers and employees from sharing their knowledge. Analyzing only the barriers within the company would limit the research process by excluding the external flow of knowledge. The aim was to analyze the external and internal knowledge sharing barriers. Identifying these barriers would help develop common solutions to overcome these barriers. Hence the main aim of this paper is to identify the knowledge sharing barriers for prosumers and global team employees which seem to have nothing in common. The contribution of this paper is showing common barriers for knowledge sharing among both prosumers and global team employees in order to fulfil the research gap extant in the literature.

The paper is organized as follows: first a literature review was undertaken regarding knowledge sharing barriers amongst prosumers and global team employees, research questions were followed by the research methodology and literature sections; then the results, analysis, and discussion; and concludes with a summary and limitations.

Role of global teams and prosumers in knowledge sharing – literature review

Global teams are defined as those with professionals located in different countries with different cultures (McDonough et al., 2001). Teams have an important role in knowledge sharing (Becker, 2003). Global teams are becoming the “new normal occurrence” as businesses expand across borders, with skill shortages forcing companies to tap into broader talent pools. It is assumed that global teams are able to integrate specialized and globally dispersed capabilities, to understand local needs and demands, and leverage cultural diversity. To achieve their objectives and ensure the employees share knowledge with their colleagues located in different parts of the world, companies undertake many activities to facilitate knowledge sharing by developing incentives and rewarding those who are willing to share. Revolutionary ideas in many cases appear on the edge of the company and in its external environment.

Thus, enterprises can also benefit from knowledge which is outside the company – from prosumers. In the case of prosumers it is very difficult to elicit exactly the border between the company and its external environment. The modern approaches to prosumers and presumption theory stress that the prosumer is an individual who can share knowledge and experience with enterprises involved in specified business activities and projects (Hernández-Serrano et al., 2017; Rayna & Striukova, 2016). In sharing knowledge, they have an impact on products and services, especially their shape, look, design, and functionality. By doing so they collaborate with companies in parallel with their involvement in their business projects (Aghamirian, Dorri, & Aghamirian, 2015; Trejo, Gutiérrez, & Guzman, 2016).

* SGH Warsaw School of Economics, Poland

** University of Economics in Katowice, Poland

Knowledge sharing barriers

Knowledge sharing barriers among global team employees

The use of global teams by companies has been boosted by developments in technology that facilitate communication between team members located in different offices around the world, and has quickly become a preferred option in high-tech firms (Monalisa et al., 2008). Developments in communication technology have led to the need to analyze the routines of work teams, in an attempt to understand what types of resources are necessary for knowledge sharing by these teams to be effective and collaborative, whether they are local or geographically distributed (Coakes et al., 2008). Table 1 presents knowledge sharing barriers based on the literature review.

The knowledge sharing barriers given in Table 1 are explained in detail below.

Absorptive capacity is a barrier to knowledge sharing. It is defined as the ability of a company to identify the value of new knowledge and to use it (Cohen, & Levinthal, 1990).

The relationships between employees from the organization, especially between members of different teams, form another barrier to knowledge sharing (O'Dell, & Grayson, 1998; Riege, 2005; Assudani, 2009). Ignorance is due to the fact that those with knowledge are not visible, so that those who need the knowledge are not aware of who has it (O'Dell, & Grayson, 1998), which is classified as a relationship barrier.

Time is identified as a barrier. Employees who are overloaded with work have difficulty finding the time to share knowledge with their colleagues (Yao et al., 2007).

Common frameworks can form a barrier, when collaboration between geographically dispersed team members is hindered due to the lack of a common framework (Assudani, 2009). The existence of a framework that represents effective knowledge dissemination is important for the global team.

Organizational structure also appears as a barrier to the effective dissemination of knowledge (Espinosa

et al., 2003). Companies consisting of silo type structures, with people divided into offices, locations and divisions, will certainly experience difficulty in transferring knowledge between the teams. This is due to the fact that team members will tend to focus solely on achieving their goals and not concern themselves with the goals of the organization as a whole (O'Dell, & Grayson, 1998).

The strategic decision to use global teams leads to some specific barriers, such as distance, time and cultural differences. Distance is cited by some authors as a barrier to knowledge dissemination (Levina, & Vaast, 2008; Kotlarsky et al., 2008; Martins et al., 2004; Assudani, 2009) as it reduces or totally excludes face-to-face interaction and makes a shared identity difficult to achieve. The fact that teams work in different time zones may be a barrier for knowledge sharing (Espinosa et al., 2003), meaning that there is a greater need for explicit knowledge to achieve an exchange of knowledge (Kotlarsky et al., 2008).

Cultural differences are listed as one of the reasons for the failure in offshore software development projects (Rai et al., 2009). Different countries have their own ways of working and these sometimes hinder interaction and cause conflicts between teams (Krishna et al., 2004).

The use of global teams by companies has benefits, although sharing knowledge becomes more complex.

Knowledge sharing barriers for prosumers

If enterprises can benefit from external knowledge, one step is to encourage prosumers to share knowledge even though the process of encouraging knowledge sharing is a difficult task (Lam, & Lambert-Ford, 2010). Typically, an enterprise leads a project where the prosumers participating have an opportunity to share knowledge. Often it is provided with various information and communication technologies (ICTs). Such projects could be delivered as a discussion forum, dedicated web page, ideas sharing platform, mobile application, etc. (Kettles, St. Louis, & Steinbart, 2017; Ford, & Mason, 2013). What is important is that it is possible to indicate the

Table 1. Barriers to knowledge sharing in global teams

Barrier	Authors
Technology	Assudani, 2009; Riege, 2005; Kyobe, 2010
Time	McDermott, & O'Dell, 2001; Riege, 2005; Yao et al., 2007
Common framework	Assudani, 2009
Silo type structure	O'Dell, & Grayson, 1998
Distance	O'Dell, & Grayson, 1998
Cultural differences	Alavi, & Leidner, 2001; Li, 2010
Professional qualifications	Remus, & Wiener, 2009
Relationship between team members	O'Dell, & Grayson, 1998; Riege, 2005; Assudani, 2009
Absorptive capacity	Assudani, 2009; Riege, 2005; Kyobe, 2010

Source: authors' own study.

factors which contribute to prosumer involvement in a specific project, including the look, design, scope and content of the project. It could be a popular ICT or a well-prepared promotion campaign as well. On the other hand, there is a set of barriers which may hinder or prevent prosumers from knowledge sharing. Based on the observation of the projects for prosumers and literature review, the relevant knowledge sharing barriers are presented in Table 2.

Table 2. Knowledge sharing barriers for prosumers

Barrier name
Time
Lack of information about opportunities to share knowledge
Lack of interest in sharing knowledge (at all)
Incompatibility of knowledge sharing with current consumer's needs
Lack of required knowledge for sharing with an enterprise
Lack of required technological skills
Lack of help or support from the enterprise
Lack of incentives
Reluctance to knowledge sharing
Reluctance to engage with a specific enterprise
Lack of physical (technological) environment for knowledge sharing
Reluctance to give private information

Source: Eisenhardt, Ziemba, & Mullins, 2018.

The literature offers two approaches to knowledge sharing namely: eagerness and willingness to share knowledge (van den Hooff, Schouten, & Simonovski, 2012; Ziemba, & Eisenhardt, 2014). The former means that prosumers are eager to share knowledge because of some personal benefits. The latter stresses that prosumers would like to share knowledge, but most would do so if their efforts were to be rewarded (Humphreys, & Grayson, 2008; Gafni et al., 2014; Ziemba, & Eisenhardt, 2016). From that perspective, the incentives can help to overcome or minimize the barriers listed above. Some researchers stress that differences exist between the willingness of prosumers to share knowledge and the generation they represent. These generational differences are especially visible in the value linked to incentives intended to encourage consumers to share knowledge (Ziemba, & Eisenhardt, 2016; Gafni et al., 2014). On the other hand, these differences may have an impact on barriers that may hinder them from knowledge sharing.

Research Methodology

Research problem and questions

The main purpose of this paper is to fill the research gap on indicating the barriers which are significant for prosumers as well as for employees

in knowledge sharing. Thus, the main research question is: which barriers are significant for prosumers and global team employees? To meet the purpose of the paper and to answer main research question the study focuses on addressing the following specific research questions:

- Q1: Which barriers are significant for global team employees?
- Q2: Which barriers are significant for prosumers?
- Q3: Which barriers are common for both employees and prosumers?

The research follows an exploratory approach to discover common knowledge sharing barriers for prosumers and global team members.

To find the answer to the main and specific research questions, as well as to present a complete picture of knowledge sharing barriers from the employee and prosumer perspectives, we combined two research methods in our study – qualitative and quantitative (Creswell, 2013). Our approach was in line with the research conducted by Rivera-Vazquez et al. (2009), which focused on overcoming cultural barriers for innovation and knowledge sharing. The authors used qualitative-based research consisting of interviews carried out among the employees and questionnaires submitted to the prosumers.

Research process

1. A critical review of existing studies to explore the concepts of prosumption and prosumer, global team employees, and barriers to knowledge sharing. The review embraced four bibliographic databases: Ebsco, ProQuest, Emerald Management, and ISI Web of Knowledge.
2. The quantitative research was planned for the prosumers, and a suitable survey questionnaire designed. The questionnaire contained a question concerning specified barriers to sharing their knowledge: what are the reasons or barriers that discourage you from sharing your knowledge with enterprises? For each barrier the respondents had to choose one of five responses, according to a 5-point Likert scale: (1) definitely no, (2) rather no, (3) neither yes nor no, (4) rather yes, and (5) definitely yes. Using the CAWI (Computer-Assisted Web Interview) method, the survey questionnaire was implemented as a website hosted on a Polish platform, Ankieta.pl. The pilot survey was conducted in November 2014. Data collection took place in 2015. The sample comprised people of different ages, genders, levels of education and ICT skills. The responses were screened and outliers excluded, which left a final research sample of 388 usable, correct and complete questionnaires. Cronbach's coefficient alpha was employed for reliability checking, which for all the analyzed items was 0.881. For that the purposes we decided to use only the outcomes from prosumers aged 35+. This decision was

made based on the assumption that there are large differences between the willingness of prosumers to share knowledge and the generation they represent. Thus, the final sample for the study was 63 prosumers, who were of a similar age to the global team employees, allowing the samples to be compared without biases. The demographic analysis of the research sample is presented in Table 3. The data were stored in Microsoft Excel format. The collected data were analyzed using Microsoft Excel and Statistica software to generate findings on the second research question (Q2).

3. Qualitative research on global team members. This research stage followed the recommendations of Dubé and Paré (2003) regarding protocol development and expert validation of the interviews. A pilot study was carried out with three interviewees, in the Poland office between September and October 2016. Following minor revisions to the wording of the questions, the main study was carried out between November and December 2016. The main form of data collection was a semi-structured interview based on eight employees from company A with its headquarters in London, UK and five employees from company B based in Prague, Czech Republic. Second, the interviewees were based in different functional departments and were chosen with the aim to obtain a broader view of the key influences that shape their perceptions. The research was based on interviews with employees from two companies (A and B) that had global teams. As they requested, the names of the companies will not be revealed. These companies were selected because they have had projects involving global teams for at least three years. Company A was a consulting company acting as the specialist in research and advisory services for the maritime sector. Founded in 1970 to provide information and advice to the global maritime industry it has since worked with over 3,000 clients in more than 100 countries. The company was privately owned, with offices in London, Delhi, Singapore and Shanghai, supported by associates across the world. Company B was a construction

Table 3. Analysis of the research sample

Demographic profile	Number of respondents	Percentage
Gender		
females	51	81%
males	12	19%
Age		
50+ years	22	35%
36–50 years	41	65%

Source: authors' own study.

company set up in 1996, based in Netherlands with offices all over the world. The key products of the company were connected with road building and hydraulic engineering. The two companies selected for the study represented the construction and consulting sectors, both of which are heavily knowledge based. Identifying knowledge sharing barriers would therefore offer many insights for practitioners and theorists in this respect.

The choice of interviewees was based on key people who possessed knowledge about the company processes, and people capable of responding to the survey questions. In company A, eight employees were interviewed, six based in the UK, one in China and one in Singapore, as shown in Table 4. In company B, five employees were interviewed with all of them based in the Czech Republic, as shown in Table 5. The interviews were conducted with the use of Skype® and each lasted 15 minutes on average.

The data were analyzed using content analysis, as recommended by Bardin (2008). The interview was validated by two professors with experience in the area.

Table 4. Profiles of interviewees in company A

Interviewee	Time in the company (years)	Experience with global companies	Working in country
A1	3	3	UK
A2	5	5	China
A3	3	20	UK
A4	7	20	UK
A5	5	10	UK
A6	1.5	1.5	UK
A7	3	10	UK
A8	10	20	Singapore

Source: authors' own study.

Table 5. Profiles of interviewees in company B

Interviewee	Time in the company (years)	Experience with global companies	Working in country
A1	10	10	Czech Republic
A2	3	5	Czech Republic
A3	5	10	Czech Republic
A4	5	10	Czech Republic
A5	10	30	Czech Republic

Source: authors' own study.

Research Findings

The findings from this study provide some critical insights into understanding the barriers that affect knowledge sharing amongst global team employees and prosumers.

Significant barriers to knowledge sharing by global team employees

In relation to the first research question „Which barriers are significant for global team employees?“ the barriers identified in the literature section were confirmed by the interviewees. When discussing the barriers, it became apparent that they were inter-related. Table 6 includes all the barriers indicated by the employees in companies A and B.

The respondents from company A listed more barriers in knowledge sharing than those from company B. The most visible barriers in companies A and B were: time, cultural differences, silo type structures and professional qualifications.

During the content analysis, professional qualifications emerged as an influential barrier to knowledge sharing. Professional qualifications can negatively affect time if knowledge is unevenly spread between team members. On the other hand, having high qualifications can positively influence the absorptive capacity. As one of the experts said (A6): „People with an IT background feel superiority over those with non-IT backgrounds, and we can find it difficult to grasp some concepts.“

Technology influences the distance as it helps to solve communication problems, as it contributes to the creation of relationships over time by providing people with contact and providing documentation regardless of where the person may be. However, technology has also another element, as pointed out by one respondent (A4) “it means people talk less and write more.”

Silo type structures was confirmed by the majority of respondents as a barrier to the knowledge sharing process. Respondent A2 compared silo type structures to a close-minded mentality. Respondent A8 added that “it allows people to stay within their own limits. People are afraid they might lose relevance and importance if they share everything.”

Cultural differences were highlighted by the interviewees as a barrier in themselves as well as influencing other barriers. Cultural differences, including language and customs, can hinder absorptive capacity and also relationships (Companies A and B).

Over the course of this study it was also possible to note some barriers that were not found in the literature. These can be grouped under one barrier: poor management (managers do not imply the importance of knowledge sharing, which is why team members use “I do not have enough time” as an excuse, so that many people protect knowledge for their own gains (A5). One respondent from company A (A3) linked management abilities to a lack of new technology skills by managers who “are inept with new technologies and don’t want to be embarrassed.” Another respondent from company B admitted that “People are afraid that knowledge sharing will lead to more control of their work by managers.” It is essential to create supportive environments (B1), as confirmed in the literature, yet attitudes to knowledge sharing as well as knowledge sharing behaviors in the organization depends on conditions that vary across institutional and cultural environments (Michailova, & Hutchings, 2006). The second barrier not mentioned in the literature review is related to the lack of time to share knowledge, which was mentioned most frequently by respondents in company A.

Time is considered a barrier, as finding the right time for a meeting on-line or telephone call is challenging, because different time zones hamper communication (Company A) and relationships as people have less time to work together (Company B). Knowledge sharing is best achieved with several team members working together within close proximity. Having team members across different countries can be essential for the business to be successful; however, it restricts knowledge sharing, as respondent A7 noted.

Having a good *relationship* within the team affects how people interact and work to overcome the barriers. It is known that we as human beings prefer to work with people who we like, which may mean we like people who have similar values to ours. A good working atmosphere influences work efficiency as we are more willing to do something for a colleague we like.

Table 6. Knowledge sharing barriers for global team employees in companies A and B

Barrier	Company A	Company B
Technology	A4	B2, B3
Time	A1, A3, A7, A8	B2, B3
Silo type structure	A1, A2, A6, A7, A8	B4
Distance	A4, A5, A7	–
Cultural differences	A3, A4, A5, A8	–
Professional qualifications	A3, A5, A6, A8	B5
Relationship between members of different teams	A5, A6, A8	B1, B3
Absorptive capacity	A1, A4	–

Source: authors’ own study.

Barriers to Knowledge Sharing for Prosumers...

Significant barriers to sharing knowledge for prosumers

To answer the second research question: “Which barriers are significant for prosumers?” frequency procedures were employed. The outcomes are presented in Figure 1.

The outcomes presented in Figure 1 show that the main barrier for prosumers to share knowledge is Lack of information about opportunities to share knowledge, indicated by 69.8% of prosumers, followed by Reluctance to give private information, indicated by 58.7% of prosumers, and Lack of interest in sharing knowledge, indicated by 55.6% of prosumers. What is more, also significant for prosumers can be Incompatibility of knowledge sharing with current consumer’s needs and Time. The less important barriers seem to be both of them, i.e. Reluctance to share knowledge, which means a general reluctance of prosumers to-

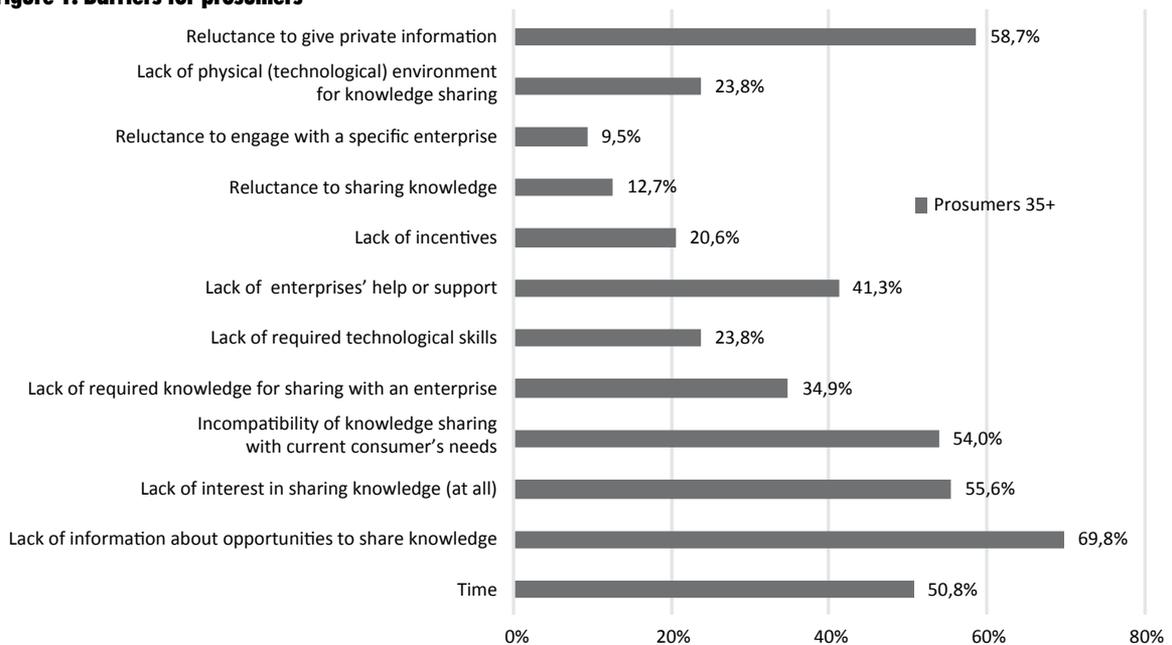
wards that activity, and Reluctance to engage with a specific enterprise, which emphasizes that the majority of prosumers do not pay significant attention to the prior bad experiences with knowledge sharing.

Barriers to sharing knowledge which are common to prosumers and global team employees

To answer the third research question: “Which barriers are common to employees and prosumers?” a conceptual framework for knowledge sharing barriers was developed (Figure 2).

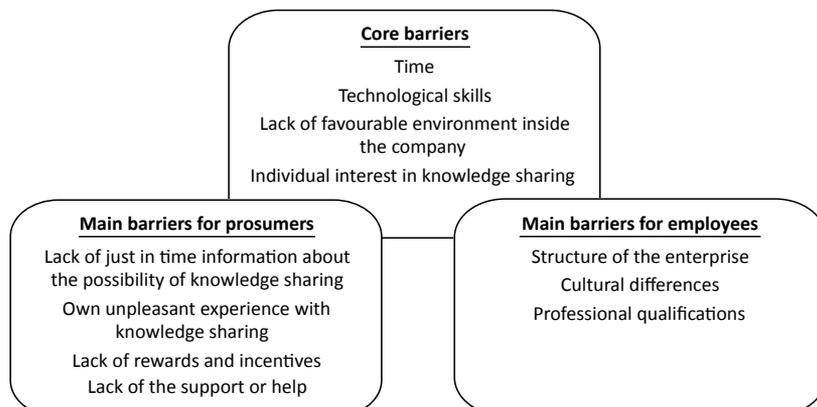
The framework presented in Figure 2 shows that there is a possibility to list core barriers which are common to both prosumers and employees. Additionally, it stresses that there are other important barriers specified separately for prosumers and for employees, which may be significant for one group and marginal for the other.

Figure 1. Barriers for prosumers



Source: authors' own study.

Figure 2. Conceptual framework of knowledge sharing barriers for prosumers and employees



Source: authors' own study.

Conclusions

The contribution of this study to the field of knowledge management is twofold. First, by identifying barriers to knowledge sharing for employees and prosumers. Second, by investigating which common barriers play a greater or lesser role in knowledge sharing for prosumers and employees.

Companies need to pay attention to the potential barriers to knowledge sharing that occur among prosumers and within global teams, in order to gain fresh understanding from prosumers and ultimately to succeed. The relevance of the barriers to knowledge sharing identified in the literature was confirmed. The barriers described by prosumers and global team members include three basic problems, i.e. lack of time, information and support related to technological issues. The benefit of using the qualitative and quantitative approach in the study was that the common barriers for knowledge sharing could be established in samples that seemed to have nothing in common.

Time was indicated as a significant barrier by both prosumers and employees. Technological issues were indicated as an important barrier in company B (construction company) where employees complained about the IT abilities of management whilst it was one of the less significant barriers for prosumers. The majority of prosumers found that the lack of information about opportunities to share knowledge was the greatest barrier for them, while for global teams it was the lack of company support or help and, more importantly, the lack of management skills. The main barrier for prosumers, which was the lack of information about opportunities to share knowledge, can be considered twofold. First, it may mean that there is a lack of suitable information for prosumers on the market, meaning that the ways that companies try to inform prosumers are insufficient or wrong. On the other hand, it could mean that prosumers do not seek the information or simply ignore it. In turn they feel that there is a lack of information about the projects in which they can actively share knowledge, even though companies offer them these possibilities very often. The greatest barrier to knowledge sharing in global teams proved to be silo type structures and time.

It was not mentioned directly, but conclusions can be drawn that as well the inability to share knowledge, by prosumers and global team employees, may be attributed to the management of companies. This is mainly about the incentives offered for prosumers. From the point of view of global team members, this inability is described as poor management skills.

The findings of this study make an important contribution to the literature on the knowledge sharing barriers in theory and practice. From the theoretical point of view the benefits of this study include an opportunity to consider that knowledge sharing barriers may be as common for groups that seemingly seem to have nothing in common, like prosumers

and employees. Thus, it has been possible to create the framework which indicates core barriers common for prosumers and employees in knowledge sharing. It also shows that some barriers exist that are unique for prosumers and for employees.

From the managerial perspective this research offers insights for managers on how significant knowledge sharing barriers are and the role of managers in minimizing them effectively.

From a practical perspective the results presented may be useful for businesses. They show a different perspective on knowledge sharing barriers. For prosumers it means companies developing incentives and building informational campaigns on-line. From the perspective of global team employees, managers should be a role model by being a positive example in knowledge sharing, they need to introduce "informational campaigns" as well by informing employees why it is necessary to share knowledge. A knowledge sharing culture is a starting point in developing a knowledge management strategy and introducing a knowledge management system. Thus finally, companies must recognize the barriers which disengage their prosumers and global team employees through knowledge sharing barriers. This is a starting point in the know how required to encourage knowledge sharing for the benefit of the company itself.

Limitations and future research

As with many other studies, this study has its limitations. The first was in the selection of the respondents. The age of the prosumer research sample was limited to prosumers aged 35+. It is advisable to extend the research to prosumers and employees into the age range of less than 35 years old. In turn, this can help to overcome the second limitation, which was the relatively low number of respondents. The research will be continued in the future, including the further significant points:

- to ensure a higher response rate for deeper analysis;
- to develop a conceptual framework with dependent and independent variables. This will facilitate the focus on comparisons between different groups and countries;
- to conduct research on employees and consumers of one specific company, and to present the results from the perspective of the employees and consumers; a deeper analysis into which barriers discourage employees and consumers from knowledge sharing.

References

- Aghamirian, B., Dorri, B., & Aghamirian, B. (2015). Customer knowledge management application in gaining organization's competitive advantage in electronic commerce. *Journal of theoretical and applied electronic commerce research*, 10(1), 63–78. DOI: 10.4067/S0718-18762015000100006

- Alavi, M., & Leidner, D.E. (2001). Review: knowledge management and knowledge management systems: conceptual foundations and research issues. *MIS Quarterly*, 25(1), 107–137. DOI: 10.2307/3250961
- Assudani, R.H. (2009). Dispersed knowledge work – implications for knowledge intensive Firms. *Journal of Knowledge Management*, 13(8), 521–532.
- Bardin, L. (2008). *Análise de Conteúdo*. Lisboa: Edições 70.
- Becker, M.C. (2003). What is the role of teams in knowledge management? Some indications from practice. *International Journal of Information Technology and Management*, 2(1/2), 50–58.
- Coakes, E., Coakes, J.M., & Rosenberg, D. (2008). Co-operative work practices and knowledge sharing issues: a comparison of viewpoints. *International Journal of Information Management*, 28(1), 12–25. DOI: 10.1016/j.ijinfomgt.2007.10.004
- Cohen, W.M., & Levinthal, D.A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152. DOI: 10.2307/2393553
- Creswell, J.W. (2013). *Research Design Qualitative, Quantitative, and Mixed Methods Approaches*. Washington DC: SAGE Publications, Inc.
- Dubé, L., & Paré G. (2003). Rigor in information systems positivist case research: current practices, trends, and recommendations. *MIS Quarterly*, 27(4), 597–635.
- Eisenhardt, M., Ziemba E., & Mullins R. (2018). Comparative analysis of barriers to knowledge sharing for Polish and UK consumers. *Polish Journal of Management Studies*, 18(2), 73–83. DOI: 10.17512/pjms.2018.18.2.06
- Espinosa, J.A., Cummings, J.N., Wilson, J.M., & Pearce, B.M. (2003). Team boundary issues across multiple global firms. *Journal of Management Information Systems*, 19(4), 157–190. DOI: <https://doi.org/10.1080/07421222.2003.11045746>
- Ford, D.P., & Mason, R.M. (2013). A multilevel perspective of tensions between knowledge management and social media. *Journal of Organizational Computing and Electronic Commerce*, 23(1–2), 7–33. DOI: 10.1080/10919392.2013.748604
- Gafni R., Geri N., & Bengov P. (2014). Investigating the effect of tangible and virtual rewards on knowledge contribution in online communities. *Online Journal of Applied Knowledge Management*, 2(2), 1–11. Retrieved from http://www.iiakm.org/ojakm/articles/2014/volume2_2/OJAKM_Volume2_2pp1-11.pdf
- Hernández-Serrano, M.-J., Renés-Arellano, P., Graham, G., & Greenhill, A. (2017). From prosumer to prodesigner: participatory news consumption. *Comunicar*, 50(XXV), 77–87. DOI: <https://doi.org/10.3916/C50-2017-07>
- van den Hooff, B., Schouten, A.P., & Simonovski, S. (2012). What one feels and what one knows: the influence of emotions on attitudes and intentions towards knowledge sharing. *Journal of Knowledge Management*, 1(16), 148158. DOI: 10.1108/13673271211198990
- Humphreys, A., & Grayson, K. (2008). The intersecting roles of consumer and producer: A critical perspective on co-production, co-creation and presumption. *Sociology Compass*, 2(3), 963–980. DOI: <https://doi.org/10.1111/j.1751-9020.2008.00112.x>
- Hutchings, K., & Michailova, S. (2006). The impact of group membership on knowledge sharing in Russia and China. *International Journal of Emerging Markets*, 1(1), 21–34. DOI: <https://doi.org/10.1108/17468800610644988>
- Kettles, D., St. Louis, R.D., & Steinbart, P.J. (2017). An experimental investigation of the individual and joint effects of financial and non-financial incentives on knowledge sharing using enterprise social media. *Communications of the Association for Information Systems*, 41. DOI: <http://doi.org/10.17705/1CAIS.04127>
- Kotlarsky, J., van Fenema, P.C. & Willcocks, L. (2008). Developing a knowledge-based perspective on coordination: the case of global software projects. *Information & Management*, 45(2), 96–108.
- Krishna, S., Sahay, S., & Walsham, G. (2004). Managing cross-cultural issues in global software outsourcing. *Communications of the ACM*, 47(4), 62–66.
- Kyobe, M. (2010). A knowledge management approach to resolving the crises in the information systems discipline. *Journal of Systems and Information Technology*, 12(2), 161–173.
- Lam, A., & Lambermont-Ford, J.-P. (2010). Knowledge sharing in organisational contexts: A motivation-based perspective. *Journal of Knowledge Management*, 14(1), 51–66. DOI: <https://doi.org/10.1108/13673271011015561>
- Levina, N., & Vaast, E. (2008). Innovation or doing as told? Status differences and overlapping boundaries in offshore collaboration. *MIS Quarterly*, 32(2), 307–332.
- Li, W. (2010). Virtual knowledge sharing in a cross-cultural context. *Journal of Knowledge Management*, 14(1), 38–50.
- Martins, L.L., Gilson, L.L., & Maynard, M.T. (2004). Virtual teams: what do we know and where do we go from here? *Journal of Management*, 30(6), 805–835.
- McDermontt, R., & O'Dell, C. (2001). Overcoming cultural barriers to sharing knowledge. *Journal of Knowledge Management*, 5(1), 76–85.
- McDonough, E.F. III, Kahn, K.B., & Barczak, G. (2001). An investigation of the use of global, virtual, and collocated new product development teams. *The Journal of Product Innovation Management*, 18(2), 110–120.
- Monalisa, M., Mirani, F., Dash, P., Khamis, R., Bhusari, V., Tugrul, D. (2008). Managing global design teams. *Research-Technology Management*, 51(4), 48–59. DOI: <https://doi.org/10.1080/08956308.2008.11657514>
- O'Dell, C., & Grayson, C.J. (1998). If only we knew what we know: identification and transfer of internal best practices. *California Management Review*, 40(3), 154–174. DOI: 10.2307/41165948
- Rai, A., Maruping, L.M., & Venkatesh, V. (2009). Offshore information systems project success: the role of social embeddedness and cultural characteristics. *MIS Quarterly*, 33(3), 617–641.
- Rayna, T., & Striukova, L. (2016). Involving consumers: The role of digital technologies in promoting 'prosumption' and user innovation. *Journal of the Knowledge Economy*, 7(1), 120. DOI: 10.1007/s13132-016-0390-8
- Remus, U., & Wiener M. (2009). Critical success factors for managing offshore software development projects. *Journal of Global Information Technology Management*, 12(1), 6–29. DOI: 10.1080/1097198X.2009.10856483
- Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management*, 9(3), 18–35. DOI: <https://doi.org/10.1108/13673270510602746>
- Rivera-Vazquez, J.C., Ortiz-Fournier, L.V., & Flores, R.F. (2009). Overcoming cultural barriers for innovation and knowledge sharing. *Journal of Knowledge Management*, 13(5), 257–270. DOI: 10.1108/13673270910988097

Trejo, J.M., Gutiérrez, J.S., & Guzman, G.M. (2016). The customer knowledge management and innovation. *Contaduría y Administración*, 61(3), 456–477. DOI: 10.1016/j.cya.2015.11.011

Yao, L.J., Kam, T.H.Y., & Chan, S.H. (2007). Knowledge sharing in Asian public administration sector: the case of Hong Kong. *Journal of Enterprise Information Management*, 20(1), 51–69. DOI: <https://doi.org/10.1108/17410390710717138>

Ziemba, E., & Eisenhardt, M. (2016). Incentives encouraging prosumers to knowledge sharing – framework

based on Polish study. *Online Journal of Applied Knowledge Management*, 4(2), 146–166. Retrieved from https://www.researchgate.net/publication/305474415_Incentives_encouraging_prosumers_to_knowledge_sharing_-_framework_based_on_Polish_study

Ziemba, E., & Eisenhardt, M. (2014). Prosumers' eagerness for knowledge sharing with enterprises – a Polish study. *Online Journal of Applied Knowledge Management*, 2(1), 40–58. Retrieved from http://www.iiakm.org/ojakm/articles/2014/volume2_1/OJAKM_Volume2_1pp40-58.pdf

Abstract

The main purpose of this paper is to determine which barriers are significant for prosumers and global team employees, and in turn what can discourage them from knowledge sharing. The main assumption was that prosumers and employees can share knowledge seamlessly, but that very often they are reluctant to do so. It seems to be a challenge for businesses to know which barriers hinder prosumers and employees in sharing knowledge. To find the answer to the main and specific research questions, as well as to present a complete picture of knowledge sharing barriers from the employee and prosumer perspectives, we combined two research methods in our study – qualitative and quantitative. The research process embraced a survey among prosumers and interviews with global team employees. The contribution of this paper is twofold: (1) a knowledge sharing barriers analysis, and (2) a conceptual framework development which presents the common barriers for knowledge sharing amongst prosumers and employees of global teams, to fulfil the research gap extant in the literature.

Keywords: global teams, consumer, prosumer, enterprise, knowledge sharing, knowledge sharing barriers

Celina Solek-Borowska gained her PhD at SGH Warsaw School of Economics, where she works as an Assistant Professor at the Management Institute, Corporate Management Department. Her research remains within the knowledge management area, including knowledge transfer between businesses and universities and as well the entrepreneurship attitudes of students. Celina has presented her research at many international conferences. She has taught in the Erasmus program for the University of Gran Canaria (Spain), the University of Hertfordshire (UK) and the University of Alicante (Spain). She is involved as an academic advisor for business projects within the CEMS program.

Monika Eisenhardt completed her PhD with a major focus on management information systems as well as changes and challenges involving modern consumers. She is an Assistant Professor at the University of Economics in Katowice, Poland. She has published over 30 peer-reviewed pieces, including conference papers, book chapters and international journal papers. She has received several *Best Paper Awards* at international conferences. Her current research focuses on consumer knowledge as well as knowledge-based organizations, especially information systems and technologies for prosumption. Monika serves as an Editorial Assistant in *Journal of Economics and Management* – the official journal of the University of Economics in Katowice.



WE RECOMMEND

E-learning Fusion conference, April 15–16, 2020, Warsaw, Poland

ELF20 gives you a unique opportunity to learn, inspire, and share knowledge and experience in the field of trends and digital learning technologies. Do you want to learn how to create a favorable learning environment in your company? Are you interested in making an efficient transformation and the latest e-learning tools? ELF20 is the right place for you!

We invite to participate in this conference the:

- development and training specialists
- managers responsible for the digital transformation of learning at the organization
- designers of e-learning solutions
- L&D experts and HR Business Partners
- middle and senior managers in the field of HR and L&D... and
- ...all those who are interested in learning technologies.

More information at <https://www.elearning-fusion.pl/mainpage-en/>



Rethinking Learning Engagement with Gen Z Students

Vickie S. Cook*

This paper examines how some expectations of Generation Z students impact faculty approaches to teaching within classrooms, both online and on campus. Methodologically, this paper relies on a literature review of various aspects of this relatively new topic, as well as participatory observation. Heutagogy is the guiding theoretical learning framework. The paper takes the form of an executive report and is addressed primarily to instructional leaders.

Introductory Remarks

Understanding the generalizable characteristics that each generation of students brings to the classroom, as well as their individual strengths and challenges, results in an ongoing need for instructors who are able to implement high impact practices in their teaching. As with all students, the most important attitude that the faculty can bring to the classroom is respect for students of all ages and at all stages. This is vital, since it is unlikely that classroom groups will comprise homogeneously aged students.

This paper explores an approach born out in the theory of heutagogy (Hase and Kenyon, 2001). Heutagogy is one aspect within the continuum of learning theories. As this learning theory is related to self-determined learning, it follows the premises of pedagogy and andragogy. The practices of heutagogy allow students to remain in control and to become self-determined learners by approaching their learning needs through a self-determined lens (Blaschke, 2012). This approach is significant when used in relation to mobile learning devices and how these devices may be used in the classroom.

The categories of learning theory as they appear on a continuum of learning may be best defined as:

- 1) pedagogy is the art and science of traditional age learners,
- 2) andragogy focuses on the learning theory of adult learners,
- 3) heutagogy is best described as self-determined learning.

A significant premise of the heutagogical approach is to utilize mobile learning opportunities to build social constructivist approaches to learning that enable learners to learn anywhere. Learning is no longer constrained by location or time. Teaching relates to a co-constructivist approach that allows members of the learning community to learn from and to teach each other. Additionally, the mobile device being used is chosen with the purposeful intention that is specific to the learning community and allows the learner to connect seamlessly with the content, teachers, and fellow students (Gerstein, 2013). This framework built upon the learning theory of heutagogy aligns well with the expectations of Generation Z (Gen Z) students.

Gen Z Students – Strengths

Learning behaviors for students today are impacted by the use of digital media and devices. This is especially true for students who were born between 1995 and 2012, a generation referred to as Gen Z. Technology has changed the personal lives of students, the work lives of teachers, how individuals learn, when individuals learn, and how the use of technology is perceived in everyday situations. Learning anytime and anywhere is a result of ubiquitous technology (Gerstein, 2013). The challenge related to the use of devices in learning is that many students know how to utilize functional applications such as text messaging, gaming, and social media, but do not know how to effectively learn using mobile devices. It is inherent when utilizing a heutagogical approach to learning that Gen Z students are taught how to harness the power of the mobile device in relation to its application in learning.

There are several positive characteristics of Gen Z students. They bring high expectations into their learning environments. They value social justice and are looking for ways to impact the world around them. They are pragmatic in their approach to learning and to life. These students have been less sheltered from

* University of Illinois Springfield, USA

the harsh economic realities that have assaulted their families than previous generations. They understand that the world is not always fair and they are not afraid to work hard to achieve what they wish to accomplish (Stansbury, 2017). Teachers can seek connections between the positive characteristics of Gen Z students to build upon these characteristics to inspire the learning of new concepts and skills.

However, teachers often only focus on the ability of Gen Z students to single-mindedly pour themselves into their digital worlds. Their ability to have digital relationships and digital communications on higher levels than previous generations can cause consternation and inhibit the understanding of how to effectively teach this generation. One author termed this generation “phigital” (Stansbury, 2017). The definition of phigital is used to describe the phenomena of living in both the physical and digital world interchangeably. While individuals who have incorporated devices into their daily and work activities may lean toward a phigital philosophy in both their work world and personal lives. Gen Z students truly display a seamless interchange between the physical and digital environments. These students do not stop to think about posting a photo of a special event to friends, they just do it. These students do not stop to think about reaching out to others who are part of their digital social network for information and advice, they just do it. The physical and digital worlds of Gen Z do not collide, they meld completely. Learning through the Gen Z lens is different and requires alternative approaches to learning (Rosen, 2010). By considering the framework of a heutagogical or self-determining approach to learning, teachers can assist Gen Z students in their need for this alternative approach to learning.

Additionally, the days of starting a class (whether online or on campus) a few minutes late or with an ambivalent opening do not resonate well with Gen Z students. Researchers have indicated the Gen Z students must be attracted by a message within 8–10 seconds or they shift their focus to a different input of information, which might be physical or digital (Fong, 2018). Being disorganized in either a face to face or online learning environment will certainly limit the amount of time a Gen Z student will spend on content or listening to a lecture.

Gen Z students are highly creative and deeply pragmatic. They have the ability to be curious young scholars who seek solutions to the problems they see around the world. They have the ability and the desire to make significant impacts on the world in which they live. They are looking for instructors who are not afraid of using technology, with its strengths and its weaknesses, to find new solutions to real problems.

Gen Z Students – the Learning Moments

Gen Z students struggle in various areas of socialization. Skills related to career and workplace expectations are critical for students today. Of these,

those often referred to as “soft skills” are also necessary for the success of the student. They include the ability to make appropriate introductions, the art of the handshake, and appropriate ways to express conflicting ideas in a collegial manner. These skills are important for this generation of students to master as they move toward the workplace. Assignments that relate to building stronger socialization skills through experiential learning or interviewing techniques can assist them in building the socialization skills needed for workplace success. This generation of students highly prizes the opportunity for experiential learning in real-world environments (Twenge, 2017). This concept is also supportive of the heutagogical connection to a self-determined learning approach. By focusing on the learner’s capacity, a teacher may design experiential assignments that promote a highly autonomous approach to developing the learning outcomes and associated skills of a course.

As Gen Z students have a tremendous reliance on technology, this ubiquitous technology should be quite prevalent in classroom assignments (Jenkins, 2019). Technologies may be utilized for the following functions:

- finding information,
- connecting to human and data networks,
- finding solutions to problems,
- building skills in the arts and humanities through virtual travel,
- visiting distant lands, museums, and other places they are unlikely to be able to visit through augmented and virtual reality.

However, other approaches that include learning strong sets of problem solving skills while limiting the use of technology is also a skill that should be planned well into appropriate activities, to strengthen critical thinking through means outside of technology (Aoun, 2017)). According to Aoun, technical skills are important for this generation to learn and understand, but equally important are conceptual skills, interpersonal skills, and the ability to understand what makes human beings uniquely human.

Strengthening activities that focus on building oral and written communication skills is most appropriate for Gen Z students. While these students communicate at a very high level with peers through acronyms and symbols, the ability to utilize written words and to develop high level speaking abilities is one that Gen Z students will have difficulty constructing without specific activities in the classroom that encourage this skill set. One excellent example of this might be found in the activity of creating student written and produced video. For video work to be done well requires high level thinking and creativity, even for a 3–7-minute video assignment with a script and a practiced delivery. This simple activity, when done well, can provide a self-determined multimedia approach to encouraging written and oral speech skill-building. The skills learned in this type of

Rethinking Learning Engagement with Gen Z Students

exercise enhance the ability of the student to build strong workplace skills (Gurchiek, 2016).

Recommendations

While it is easy to conclude that Gen Z students feel entitled, they do not exhibit the same level of entitlement that the millennial generation did. They do want instant gratification related to finding answers to basic problems (Wilkie, 2017). Gen Z students are also significantly less collaborative than their previous millennial counterparts. They seek ways to assert their individuality while working within a larger group; this is aimed at empowering an organizational culture toward making an impact. Professors who focus on ways to encourage individuality within the coursework, including group work and ways for each individual to bring their own creativity and ability to build on autonomous learning to the course room, will find students who engage with the learning activities and eager to excel.

In concluding, the author proposes three questions for the instructor to consider when planning a course activity:

1. Are the students allowed to determine how to expand learning through using technology as part of the lesson plan?
2. Are the students finding pathways toward self-determined learning through heutagogical practices in the class?
3. Is device neutrality practiced to allow students to choose the device and app that most effectively works for them to prove they have met the learning outcomes?

To sum up, teaching this generation of students requires the faculty to find new ways to think about content, activities, and assessments. Teaching this generation of students will require that instructors consider self-determined, autonomous heutagogical methods that allow the students to utilize creativity and self-directedness in their learning journey. Choosing a heutagogical approach will move the instructor from the center of the learning process to the side, as a coach or mentor, while the student moves to the center of the learning process. An active respect for generational differences should always be present, but none more so than when integrating the use of technology in the learning activity. In regard to Gen Z students, educators should engage them through building mutual respect, sharing scholarship

and best practices surrounding technology usage in learning, and sharing the responsibility of learning with the students.

References

- Aoun, J.E. (2017). *Robot-proof: higher education in the age of artificial intelligence*. Boston, MA: Massachusetts Institute of Technology.
- Blaschke, L.M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distance Learning*, 13. Retrieved from <http://www.irrodl.org/index.php/irrodl/article/view/1076/2087>
- Fong, J., Lucchi, M., Trench, B., Lope, N., & McDermott, P. (2018). *An insider's guide to planning for the inevitable: Generation Z and higher education*. UPCEA. Retrieved from <https://upcea.edu/generational-politics-and-the-new-4th-edition-of-an-insiders-guide-to-generation-z/>
- Gerstein, J. (2013). Education 3.0 and the Pedagogy (Andragogy, Heutagogy) of Mobile Learning. *User Generated Education, Blog: @jackiegerstein*. Retrieved from <https://usergeneratededucation.wordpress.com/2013/05/13/education-3-0-and-the-pedagogy-andragogy-heutagogy-of-mobile-learning/>
- Gurchiek, K. (2016). Think Gen Z Isn't That Different? Think Again. *Society for Human Resource Management*. Retrieved from <https://www.shrm.org/resourcesandtools/hr-topics/behavioral-competencies/global-and-cultural-effectiveness/pages/2016-talent-management-conference-jeff-hiller-gen-z-globals.aspx>
- Hase, S., Kenyon, C. (2001). Moving from Andragogy to Heutagogy: Implications for VET. Retrieved from https://epubs.scu.edu.au/cgi/viewcontent.cgi?article=1147&context=gcm_pubs
- Jenkins, R. (2019). *How Generation Z Uses Technology and Social Media*. @theRyanJenks. Retrieved from <https://blog.ryan-jenkins.com/how-generation-z-uses-technology-and-social-media>
- Rosen, L.D. (2010). *Rewired: understanding the iGeneration and the way they learn*. New York: Palgrave MacMillan.
- Stansbury, M. (2017). The Rising "Phigital" Student. *edCircuit*. Retrieved from <https://www.edcircuit.com/rising-phigital-student/>
- Twenge, J.M. (2017). *iGen: Why today's super-connected kids are growing up less rebellious, more tolerant, less happy – and completely unprepared for adulthood – and what that means for the rest of us*. New York: Atria Books.
- Wilkie, D. (2017). Managers Not Too Enthusiastic About Generation Z Coming to Work. *Society for Human Resource Management*. Retrieved from <https://www.shrm.org/resourcesandtools/hr-topics/employee-relations/pages/generation-z.aspx>

Abstract

Hase and Kenyon (2001) explored the learning theory of heutagogy along the continuum of learning theories. Heutagogy provides a framework for self-determined learning and follows the continuum created through the theories of pedagogy and andragogy. However, the practice of heutagogy allows students to remain in control of their learning through the application of self-determined learning. This approach is significant when used in relation to mobile learning devices. This theory is highly relevant in considering how to best provide learning for Gen Z students, born between 1995 and 2012. This paper suggests there are benefits in exploring Gen Z student learning through a heutagogical application.

Keywords: heutagogical learning, generation Z, mobile learning, co-constructivism, self-determined learning

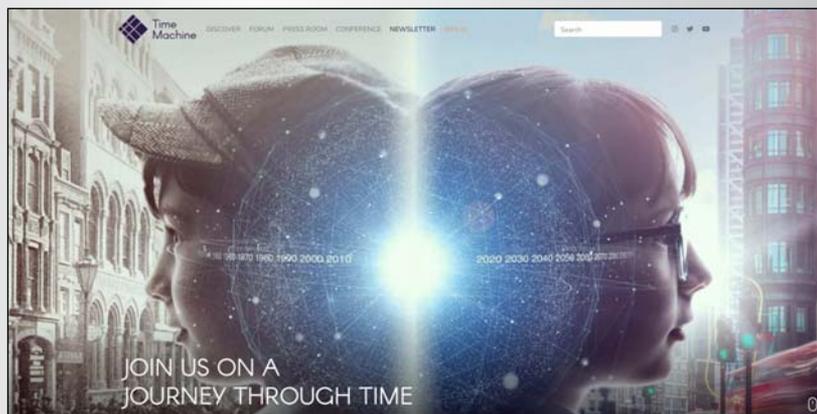
Dr. Vickie Cook is the Executive Director of the Center for Online Learning, Research and Service (COLRS) and Research Professor in the College of Education at the University of Illinois Springfield. She holds a Ph.D. in Higher Education Administration and an M.S. in Adult Education. Dr. Cook has been actively engaged in providing consulting and faculty development for educational leaders across the USA, Canada, and Mexico. She has provided consultations to over 40 institutions. She has published over 30 journal articles and book chapters in a variety of educational publications in the United States and she serves as a peer reviewer for six of the top journals in the field of Online Learning. Dr. Cook was named a 2017 University of Illinois President's Executive Leadership Fellow and a 2017 Online Learning Consortium (OLC) Fellow.

WE RECOMMEND

Time Machine Europe

Unlock the rich past of our cities

The Time Machine Project is by far the most ambitious and far-reaching project ever undertaken using Big Data of the Past. Revolutionizing the way we experience European history and culture, the project is an international collaboration to build a map of European history that spans thousands of years. This open access, living resource will aid everyone from acade-



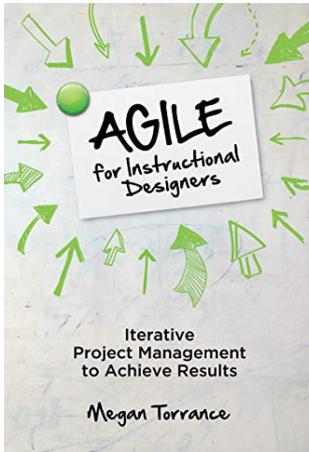
tics to industry, sparking interest in the future generation of humanities scholars, pushing the limits of science and technology, and allowing the general public to explore their own past. The project got funding in 2018 from Horizon 2020 – the European Union research and innovation programme, but actually the local time machine projects started several years ago.

Meet the local time machines

The Venice Time Machine was the first project developed by Frédéric Kaplan from the Digital Humanities Laboratory at the Swiss Federal Institute of Technology in Lausanne (EPFL). He had the ambition to capture well over 1,000 years of records in dynamic digital form, encompassing the glorious era of the Most Serene Republic of Venice. Kilometers of archives were digitized, transcribed and indexed, forming the largest database of Venetian documents ever created.

Now, the network of Local Time Machines comprises 17 projects across Europe, including Paris, Amsterdam, Antwerp and Utrecht, Barcelona, Budapest, Ghent/Bruges, Limburg, Dresden, Nuremberg, Venice and Naples, Sion, and one in Jerusalem. More information at <https://www.timemachine.eu>





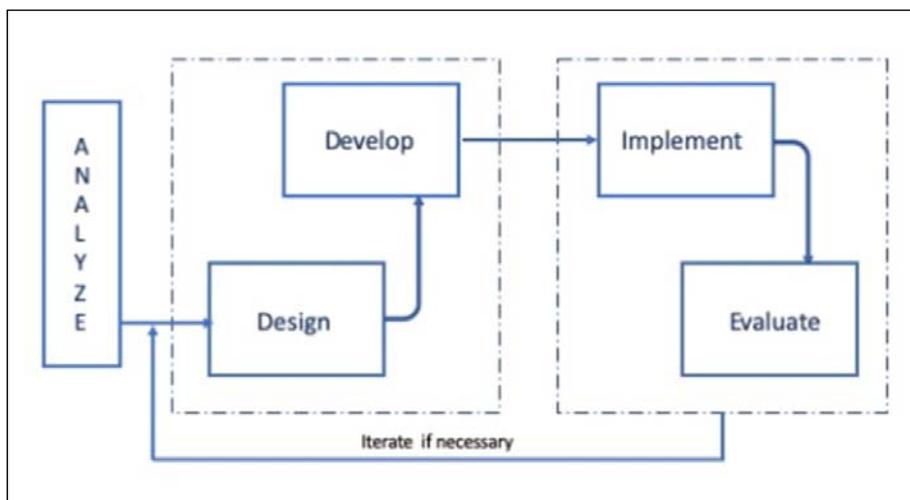
Agile for Instructional Designers – review of the book by Megan Torrance

Maria Zajac

Megan Torrance is a practitioner who leads the e-learning design and development firm. In her book **Agile for Instructional Designers. Iterative Project Management to Achieve Results**, she presents how to apply the agile methodology for designing an e-learning experience. She argues that the ADDIE¹ model still commonly used in instructional design does not suit the needs of contemporary learners, and therefore it should be replaced by a more flexible approach. Flexibility means, in this context, openness to change, which can be introduced even while the training or the course is being delivered. The author of the book claims that the agile approach, well known from software development practices, can be effectively used to support the traditional approach to designing the learning experience. Hence, she introduces first her own, concise definition of agile, and then describes the methodology of using the agile approach to instructional design which she calls LLAMA from the words Lot Like Agile Management Approach.

According to Torrance, “Agile is an iterative, incremental method of guiding the design and building projects in a highly flexible and interactive manner, focusing on maximizing customer value and fostering high team engagement.” The practice of software development has proved that testing and evaluating the “product” during the design process rather than at the end of it is much more effective and leads to higher customer satisfaction. The author observes that the final evaluation of the courses and pieces of training cannot be beneficial for the current learners, it may help to improve the course for its future participants but not for the present. In the LLAMA approach, it is possible to accommodate changes when necessary, for instance, when the managers decided to equip a particular group of the staff with tablets and therefore mobile access to the course content appears to be essential for them.

It is worth to stress, however, that agile methodology itself is not a learning design method. Therefore, Torrance developed the LLAMA model, which she



Source: own elaboration based on the book being reviewed

¹ The acronym ADDIE stands from Analysis, Design, Development, Implementation, and Evaluation.

calls in short, the ADDIE model adapted for Agile. The core assumption applied in the model is that changes are introduced iteratively, i.e., the development phase can be repeated (iterated) several times, depending on the flow of implementation followed each time by the evaluation phase. The author points out that “rather than assuming that the initial analysis covered every aspect and that no changes will be requested during design and development, the Agile approach implies a continuous return to the design and development phases after prior evaluation.” Such an approach transforms the course creation process into a multi-stage project, completed in small increments. After each stage, its result (a course or a part of it) can be viewed, used, and tested by the learners and those who ordered it. As Torrance says, “this gives teams the chance to identify problems not previously anticipated or reevaluate features or functions that might not work in practice as they had envisioned.”

Explaining the idea of how an agile methodology can be adjusted to the needs of learning designers constitutes the introductory part of the book. Then the three main parts come, named subsequently: Kicking Off the Project, Managing the Project, and Applying Agile in Your Organization.

Kicking off the project refers to the meeting when not only the goal and scope of the project must be defined, but also the learner and his/her needs are identified. Applying the rule that “one size does not fit all” requires an accurate description of the learner. Torrance recommends using the concept of “learner personas,” very common among marketers. In other contexts, the names “user stories” or “empathy maps” are used as well. The point is that during the course design, “understanding the target customers’ routines, pain points, needs, aspirations and prior knowledge or comfort with what will be delivered to them” may help to improve the original outline of the course. In practice, the learners can usually be represented by three to five personas. It is not only about being a beginner or an advanced learner. Creating the persona means assigning to it as many “real people’s” features as possible, e.g., their interests, motivations, recreational activities, professional goals, the level of comfort with technology. Then indicating the “primary learner persona” (PLP) helps to decide whose needs are to be met first, and in consequence to concentrate on those parts of the course, which are crucial for PLP because they are vital for the organization as well. Such an approach, quite well known in organizational settings, is not so common in educational contexts. Getting familiar with it is one of the reasons why this book is worth reading, especially by the instructional designers employed at the universities.

Concerning the management of the project, it should be remembered that planning the iterations in the project work, maintaining regular lines of communication, and facilitating retrospectives are vital for its proper flow. For the latter, it is crucial not

to focus too much on the things that went wrong. A much more valuable part of the retrospection would be to try to formulate suggestions for improving the process instead.

As the book is intended to help people better design the learning experience, it is strongly practice-oriented, and every chapter ends with the sections *What Could Possibly Go Wrong?* and *Key Takeaways*. The actual value of the first is drawing the attention of the designers to those tiny things, which might often seem obvious, but they are not. Just to give a snip of what is meant one or two examples. First – borrowed from the *Define the Goal* chapter – one of the key takeaways states, “The goal is never to create the training. The goal is to improve performance, and training may be among deliverables that you use to meet the goal.” There are far too many courses built around the goal of creating the training. Another example comes from *Define and Estimate Tasks* chapter – among the things that could possibly go wrong, the author mentions, “You think about estimating duration instead of effort.” In the same section, one of the key takeaways is Torrance’s advice to follow four rules of estimating. And the rules are as follows: “Rule #1: Break things into smaller feasible chunks; Rule #2: The person who does the work estimates the work; Rule #3: Estimate based on what you think it will take to do the work, with no padding; Rule #4: Account for the uncertainty of large things.”

The book ends with two appendices. The first one is called *The Agile Manifesto and 12 Principles for L&D Teams*, this title speaks for itself. The second appendix is called by the Author *the Job Aids* because it offers the sample *Project Kickoff Session Agenda*, *the Learner Persona Question List*, *Learner Persona Template*, *the Written Status Report Outline* and even the template for *Capturing Retrospective Feedback*. The practical approach to the course designing process is clearly visible throughout the whole book. It is written in a very concise but informative way. It is worth to stress that although the LLAMA concept was developed in the business settings, it may equally well be applied in the educational context. In my opinion, one may consider the LLAMA approach as a valuable contribution to solving the problem of adjusting the online courses to the diversified needs of the learners. I would recommend this book as a must-read position for every instructional designer. Even if they do not find a definite answer to their problems or decide not to adopt such an approach into their practice, they still could benefit from it.

The book *Agile for Instructional Designers, Iterative Project Management to Achieve Results* by Megan Torrance was published by ATD (Association for Talent Development) Press in 2019. It can be purchased directly from the publisher’s website (<https://www.td.org/books/agile-for-instructional-designers>) or on Amazon.com.



Making Art with 3D Laser Cutting. Audio-enriched Tactile Poetry

Michael Kolitsky*

A 3D laser cutter was used to produce lines of poetry from acrylic sheets that can be configured in real world 3D space to make tactile poetry more accessible to a blind or visually-impaired reader. The process of positioning laser cut lines of poetry in 3D space for greater accessibility led to the unanticipated outcome that real-world 3D shapes could now be viewed or sensed as mixed medium art that was accepted in juried tactile art exhibitions. Tactile art exhibits are becoming more common and are part of the venue for many creative art centers, museums and art galleries across the United States and in other countries. The aim of this paper is to describe the process of making real world audio-responsive tactile poetry and show how the lines of poetry can now be configured in 3D space so as to be viewed as mixed medium tactile art.

When lines of poetry exist in 3D space, as in a 3D haiku poetic cube¹ (Tweedie and Kolitsky, 2002), the use of a screen reader does not easily permit reading of all the ways that the lines of a 3D poem may be configured in 3D space. More supportive templates and use of iPads as audio sources (Kolitsky, 2016) have been shown to provide a reader who is blind or visually impaired the same opportunities as a sighted reader to experience reading poetry in 3-dimensional space. The interface when using an iPad as an audio source must be 2D, such as seen in a raised line graphic so that a blind reader can know where to touch the raised line graphic in order to trigger an audio button on the iPad. The 2D template was an important advance in creating an interface to allow a 3D haiku poem to be read in the same way as that by a sighted person. A blind reader, however, is required to make a 2D to 3D leap in an attempt to imagine what a 3D haiku poem actually looks like in the real or digital 3D world. It is more valuable and rewarding for a blind reader of 3D poetry if they have an actual real-world model of the 3D poem, so that they can touch and feel the structure and location of each line in a 3D poem. This type of tactile poetry made to exist in the real world provides a bridge for the blind reader to cross

from just hearing the poetry to building in their minds a structural image of the poetic shape in which meaning, interpretation and the sense of touch coalesce to form a tactile work of art. It is the aim of this report to show how 3D tactile poetry can be recreated as a 3D tactile work of art using laser cutting technology.

Examples of 3D Laser Cut "Talking" Tactile Art

A number of exhibits in museums and creative art centers in the United States and else where in the world have announced calls for tactile artwork designed around the theme of "please touch the art," such as at Newseum Tactile Art (NFB, 2018), Somatosensory exhibit (Carnegie Library, 2018), "Please Touch the Art" (Smithsonian, 2018) and "Touch and See" (NEA Arts Magazine, 2015). The examples of "talking" tactile poetry included in this report were all made by the author and have been accepted by jurors for display at several locations around the USA for inclusion in their tactile art exhibits.

Ferris Haiku

Figure 1 shows a real-world laser cut version of a "Ferris Haiku", patterned after an animation written using Flash software in 2001². The laser cut version of the "Ferris Haiku" in the shape of a real-world Ferris wheel was designed and made to allow an audio response when the buttons were touched. The "Ferris Haiku" can be rotated by hand, and the buttons on the side can be touched to play the audio for a particular haiku poem. The "Ferris Haiku" mixed medium art piece was accepted in the juried "Please Touch the Art" exhibit for display at the Mosesian Center for the Arts in Waterford, MA, which ran from June through to August 30, 2019. A second version of the "Ferris Haiku" was also accepted by the jury process for the "Touch the Art Exhibit" at the McKeon Center for Creativity in Tulsa, OK, from June 7 to July 30, 2019, while a version was also accepted at the 18th Annual

* University of Texas at El Paso, USA

¹ Kolitsky, M.A. (2006). <http://www.nextgenemedia.com/3DHaiku/3dhaikuCube.html>

² Kolitsky, M.A. (2001). <http://www.nextgenemedia.com/FerrisHaiku1.html>

Gala Juried Fine Arts Exhibition at the Arts Center in Elkins, WV, which ran from June 10 through to July 21, 2019. Most recently, on October 18, 2019, the “Ferris Haiku” piece received a “Best in Show” first place selection at the ART Libris – 22nd Annual Art Show at the Pequot Library in Southport, CT.

In Figure 1, note that the rectangular templates containing laser cut haiku poetry can be rotated like a Ferris wheel, allowing the templates beneath to become visible and ready to be read during the next rotation. There are buttons located on the side which can be pressed for an audio reading of the haiku poetry on each template and also for recording poetry by people visiting the art exhibit, making this piece “unfinished” as more poetry can be added throughout the exhibit period.

Figure 1. “Ferris Haiku” showing how templates can be rotated like a Ferris wheel



Source: author’s own work.

Merry-Go-Round Haiku

“Merry-Go-Round Haiku” was also selected to appear in the juried “Please Touch the Art” show at the Mosesian Center for the Arts in Waterford, MA, which ran from June 7 to July 30, 2019. The “Merry-Go-Round Haiku” is a 3D laser cut tactile art piece designed to hold four haiku poems. The “Merry-Go-Round Haiku” can also be rotated by hand in either the counter clockwise or clockwise direction and could be named a “Carousel Haiku” or “Round about Haiku” dependent upon the local custom where the tactile art resides. Each haiku template on the “Merry-Go-Round Haiku” contains audio-response buttons, so that by touching a button in the upper right portion of a 3D haiku template causes the audio for that haiku to be played. The buttons on the upper left and lower left of a haiku template, when pressed simultaneously with the button on the lower right, cause a double beep to occur to indicate the start of audio recording. When the audio recording is complete, pressing the upper left or lower left button causes a single beep, indicating that the audio has been saved. By pressing either the upper left button or lower left button the recorded audio can be played. The option to add poems to the “Merry-Go-Round Haiku” also makes the 3D laser cut tactile art piece an unfinished work of art, with poetic contributions by the visitors encouraged throughout the exhibition. The “Merry-Go-Round Haiku” templates are colored red, and each template has the entire haiku poem for that template laser cut on the template so a sighted or deaf visitor can read the haiku on that template. When the button on the upper right is pressed, the poem cut into the template is played with the artist’s voice so that a blind visitor can hear what a sighted visitor sees and hence completes the expectations for meeting Universal Design standards (Universal Design and Accessibility, 2018). A “Merry-Go-Round Haiku” is shown in Figure 2.

Figure 2. Merry-Go-Round Haiku showing a side view of a template with a haiku laser cut into it



Source: author’s work.

Making Art with 3D Laser Cutting. Audio-enriched Tactile...

Figure 2 also shows the locations of the buttons for both playing and recording the audio. The “Merry-Go-Round Haiku” can be rotated either in a counter-clockwise or clockwise direction.

Sagittarius A as Tanka

The next work, shown in Figure 3, has two tanka poems in a 3D real world form and demonstrates how the lines of multiple tanka poems (5-7-5-7-7 line syllables) arranged in an X format can share the same middle line and hence be used to create a mixed medium art piece that builds on the theme that information in lines of poetry, like any information stored in our Universe, is never destroyed, and that when it enters the edge of a black hole, as is thought to exist at the center of our galaxy, it becomes stretched at the event horizon to exist solely as 2D information in the form of a hologram. Hence the name of these art pieces, “Sagittarius A Tanka”, is tied to the black hole in the center of our Galaxy, known as “Sagittarius A” or “SagA*[®]”. These new “talking” tactile art pieces may then be thought of as a reflection of the information contained in them, which is never destroyed but can be imagined to be stored in a black hole event horizon awaiting our call to retrieve them for interpretation and analysis.

Figure 3: Sagittarius A shows two tanka poems sharing same middle line (RISKY ENCOUNTER) attached to a black platform (surface of black hole) using right angle brackets. Pressing the small buttons linked to

each bracket produces audio for that particular Tanka line. Pressing the buttons near the center edge at the same time as the button at the bottom near a tanka line produces a double beep indicating the audio recording option is operating. When the audio button at the bottom near the tanka line is pressed, a single beep is produced to indicate that the new audio is now saved and can be produced again by pressing the same red button. Dimensions: 12 inches wide, 10.5 inches deep and 16 inches high.

Bits to Memes

The Art League Rhode Island in Providence, RI, had a call for the exhibit “One Zero One” which focused on our digital world being dependent upon a binary system composed of the numbers zero and one, and which form the basis for all computer code. The image below shows the mixed medium acrylic “book” that was selected to be part of the show, which runs from September 16 through November 15, 2019. Figure 4 shows the three page acrylic book with one line of a haiku cut out on each page, and beneath each haiku line are the numbers, zeros and ones, that form the bits forming the bytes (8 bits for each byte forming a letter in a haiku) and together generate the memes that we now can exchange on the internet.

Figure 4 contrasts the text that we can read with the binary code that a computer can read. The actual lines of the haiku “Bits to Memes” are: on page 1 “as bits change to bytes”, on page 2 “base 2 shines revealing

Figure 3. Sagittarius A X1 (Twotanka in an X shape arrangement share the middle line)



Source: author's work.

Figure 4. Bits to Memes (compares binary code with text)



Source: author's work.

memes” and page 3 “best and worst of us”. A small button on the lower left of each page can be pressed to play the audio for the haiku line on that page.

Cube of Poetry

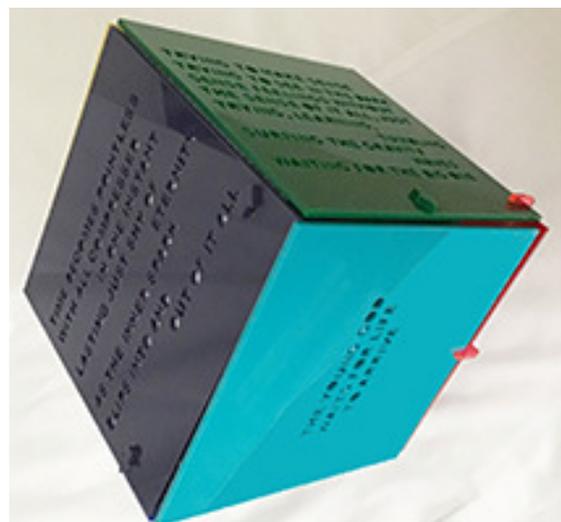
The Pequot Library in Southport, CT, sponsored a call for art at Art Libris, for the library’s 22nd Annual Art Show. This show celebrates the intersection of word and image. The author submitted several pieces, but shown below is one that exemplifies the artist’s view of making tactile poetry accessible as art. A cube composed of different colors of acrylic was designed, with each side of the cube’s six sides containing a portion of the poem “Timeless Patience”, written by the author. Figure 5a shows a top view angled to get a sense of the cube arrangement. What is not shown is that the cube sits upon a black cylinder pedestal assembled from acrylic cut into a cylindrical shape using a laser cutter. This piece is also made so that it can be picked up and rotated by hand for viewing the sides of the cube not easily seen from a single viewpoint.

Note that Figure 5a is described as “closed” because the cube can be opened to reveal the poetic lines translated into Braille for touch reading by blind patrons, as shown in Figure 5b. Raised arrows on each of the cube faces give the direction for reading the poem, which starts on the title face or page 1, then moves to faces 2 and 3 to be read in that order, with the cube faces rotated by hand to show the text. On face 3, there is the opportunity to choose to read either face 4 or face 5 next, and then the last portion of the poem on face 6. This means that there are two poems intermingled into one poetic cube, dependent upon whether the reader chooses the poetic lines on face 4 or face 5 before the final lines on face 6.

The cube of poetry is held together by magnets to allow face 1 of the cube to be separated from face 6, so that the cube can be opened to lay flat, revealing on the inner surface of each cube face the same lines that appear on the exterior surface except now they are in Braille. The Braille is produced using swell or microcapsule touch paper on a Tactile Graphics machine obtained from American Thermoform (American Thermoform, 2019).

The acrylic “pages” are held together by a hinge formed from flexible black tape so that two pages can be easily opened and then shut again multiple times. The magnets are held in place by glue, and the connection between the red and blue faces (faces 1 and

Figure 5a. Cube of Poetry (closed)



Source: author's work.

Making Art with 3D Laser Cutting. Audio-enriched Tactile...

Figure 5b. Cube of Poetry (showing Braille inside when open)



Source: author's work.

6 on the closed cube) are also held together by Velcro pads that can easily be pulled apart to open the cube and then close it again.

3D Laser Cutting (Hardware and Software Used)

A Glowforge Basic 3D laser cutter (Glowforge, 2019) was purchased mid-2018 which uses an on-board computer and a powerful laser to cut through 3–6 mm thick acrylic plastic sheets of different colors. The acrylic plastic sheets were purchased primarily from Glowforge as part of their Proofgrade collection. The Proofgrade acrylic sheets measure 12 inches x 20 inches and are available in 1/8 inch and 1/4 inch thick versions and priced from \$12.00 to \$18.00 per sheet. The Proofgrade acrylic is designed for optimal use with CO2 laser technology and lab tested for accurate printing. The Glowforge laser can both engrave and cut through the acrylic sheet, but for this study only the laser cutting was employed, with line drawings used as a guide for the laser to follow for cutting through the acrylic. Once a Glowforge laser cutter is purchased, a catalog of designs is available for printing, but in this study, the text for a poetry line is first converted into a scalable vector graphics (svg) file that can be used for laser cutting.

Making scalable vector graphics (svg) files for laser cutting

A MacBook Pro was used for making the svg files for laser cutting, but a PC would work as well. For the “Ferris Haiku” and “Merry-Go-Round Haiku” projects in this study, solid text was first typed onto a rectangle graphic drawn in Photoshop (Photoshop, 2019) and circles were also drawn where holes were needed for the machine screws to hold each rectangular acrylic

in place, and the file was then saved as a jpeg file before being converted later to an svg file for the laser cutting. For the “Sagittarius A” models in this study, the warp option in Photoshop was also used to widen the text graphic on the left side near the base of the platform used for attachment of the text following laser cutting. The solid text for the “Sagittarius A” models in this study was also changed into outlined text (Photoshop CAFÉ, 2019) to produce solid text in the acrylic sheet when laser cut. A one-inch rectangular graphic with a hole cut in it was also added for attaching the laser cut text to a metal right angle joint for connection to the platform forming the base of the “Sagittarius A” models. A 3 mm wide rectangular graphic was also added underneath the text to have a platform for the text to adhere to when laser cut.

Super Vectorizer 2 Mac (SuperVectorizer, 2019) was used to convert the jpeg files into svg files. Super Vectorizer 2 Mac converts jpeg files into svg files by setting the working window options to “Line” and “Skeletalization” with a “Threshold” value of around 60, “Smooth Line” option set to 200 and “Reduce Noise” option set to 15. These settings can be adjusted so that the jpeg file after loaded into Super Vectorizer has no peripheral line breaks, as the laser cuts along black lines, and if a text letter does not have a complete line forming it then the laser will not cut completely around the letter component and that letter will not be easily removable from the acrylic sheet.

Making tactile art “talk”

The inclusion of audio generating tools, such as seen in audio-responsive greetings or birthday cards from bigDawgs (bigDawgs, 2019), provides a way to match touching a line with the audio for that particular line of poetry. Push button modules were used for

audio delivery of poetry lines and also push button options were available for recording fresh audio so that tactile art show attendees could record their own poetry and have it available for others to hear. The compact thin size of the audio recording and generating devices from bigDawgs permitted their placement inside the space underneath the platform to which the acrylic poetry lines are attached. The activating buttons for generating or recording the audio can then be placed on the surface of the platform near the site where the individual lines of poetry are attached.

From Accessibility to Art

The path followed to explore making laser cut lines of 3D poetry accessible to the blind or visually impaired reader has, surprisingly, led to the recognition that tactile poetry in 3D space can also be used to produce mixed medium tactile art pieces. This observation is similar to work that others have done in visual poetry (Michael and Sara Biggs Chaney, 2018) and leads one to predict that visual poetry can also be made into tactile poetry in 3D space using the methods described in this report. All of these studies affirm the importance of including Universal Design principles (Universal Design and Accessibility, 2018) into the planning process from the beginning when making accessible elements for learning via touch generated audio components. There is also an interesting and satisfying process of discovery in finding that the viable accessible solution is also one that includes an artistic component.

Abstract

Poetry written for display in 3D digital space presents challenges for blind or visually impaired readers. One approach to making 3D poetry more accessible is to design real-world 3D models of the poetry lines so they can be touched and made audio responsive. The unpredicted effect of making talking tactile poetry models is that they now can be viewed as works of mixed medium art. Some of them have even been accepted into juried tactile art shows, which are becoming more common in national and international art centers, museums, and art galleries. This report explains how 3D laser cutting technology is used to make audio-responsive 3D poetry mixed medium art pieces highlighted by a "Best in Show" award at a national art show in October 2019 for a piece titled "Ferris Haiku". It is of interest to note that making 3D poetry accessible can also lead to a tactile mixed medium art piece.

Keywords: 3D laser cut, poetry as art, acrylic sheets, accessibility

Michael A. Kolitsky received his Ph.D. from Temple University in Philadelphia, PA, and is now retired but teaching online for the University of Texas at El Paso (UTEP). Mike was a tenured professor of Biology at UTEP and also was appointed Associate Vice President for Instructional Technology overseeing the technology design and faculty training for a new Undergraduate Learning Center. He was the Principal Investigator for a 2.5 million dollar NASA grant to establish an instructional support and training center at UTEP for University and regional K-12 instructors. Mike also received a University of Texas Chancellor's Distinguished Teaching Award at UTEP and earlier was awarded a Distinguished Natural Sciences Curriculum Innovation award for his Embryology videodisc and HyperEmbryo courseware from EDUCOM. After leaving UTEP, he was appointed a founding board member for NJEDge.Net, the higher education network for New Jersey and served as Dean of Academic Computing and Distance Education at Atlantic Cape Community College prior to retirement. Mike was a consultant for the Rutgers University Library FIPSE grant to establish the New Jersey Digital Highway and also assisted in the production of several shared content objects (SCO's) with the University of Wisconsin-Madison Academic ADL Co-Lab FIPSE-sponsored effort to support effective online teaching. Mike is currently exploring how 3D laser cutting technology can be utilized in making audio-responsive tactile templates for learning cell biology and anatomy by students who are blind or visually impaired.

References

- bigDAWGS. (2019). Retrieved from <https://bigdawgs-greetings.com/>
- Glowforge. (2019). Retrieved from <https://glowforge.com/>
- Touch and See Exhibit. (2015). Retrieved from <https://www.arts.gov/NEARTS/2015v1-challenging-notions-accessibility-and-arts/touch-and-see>
- Kolitsky, M.A. (2016). 3D printing makes virtual world more real for blind learners, *e-mentor*, 1(63), 65–70. DOI: 10.15219/em63.1222.
- National Federation of the Blind. (2018). <https://www.facebook.com/NationalFederationoftheBlind/videos/10156257710819248/>
- Photoshop CAFÉ. (2019). Retrieved from <https://photoshopcafe.com/tutorials/outline/outline.htm>
- Please Touch the Art: This Artist Creates Tactile Portraits for the Blind. (2016). Retrieved from <https://www.smithsonianmag.com/travel/artist-making-tactile-art-blind-using-screws-180959716/>
- SuperVectorizer. (2019). Retrieved from <http://www.svgvector.com/>
- Tactile Art Exhibit Somatosensory 2018: Relating to the Senses. (2018). Retrieved from <https://archive.triblive.com/lifestyles/morelifestyles/14282880-74/carnegie-library-removes-do-not-touch-element-with-tactile-art-exhibit>
- Tweedie, S., Kolitsky, M.A. (2002). 3-D Haiku: A New Way to Teach a Traditional Form, *English Journal*, 91(3). Retrieved from <http://www.ncte.org/journals/ej/issues/v91-3>
- American Thermoform. (2019). Retrieved from <http://www.americanthermoform.com/product/swell-touch-paper/>
- Michael and Sarah Biggs Chaney. (2018). Retrieved from <https://www.michaelandsarachaney.com/>
- Universal Design and Accessibility. (2018). Retrieved from <https://www.section508.gov/create/universal-design>

e-mentor

INFORMATION FOR THE AUTHORS

Publishers: Warsaw School of Economics (SGH) & Foundation for the Promotion and Accreditation of Economic Education

Editorial Office: Al. Niepodleglosci 162/ 150,
02-554 Warsaw, Poland, tel./fax: +48 22 646 61 42
E-mail address: redakcja@e-mentor.edu.pl

ABOUT THE JOURNAL

E-mentor is an academic journal published both in printed (in 1200 copies distributed for free) and in the open access electronic form. Throughout the last 14 years, it became a well-established peer reviewed academic journal, officially listed by the Polish Ministry of Science and Higher Education as one of the highest ranked (15 points) scientific journals. It is distributed to the numerous university libraries and other educational institutions, as well as to individual subscribers from academia and business. Due to the growing interest and number of submissions from other countries e-mentor is now becoming an international journal with certain editions published fully in English. Creating high quality, peer-reviewed content that is used by researchers, students and practitioners around the world remains our commitment and ambition.

SUBJECT AREAS

Originally established as the journal on e-learning, e-business and knowledge management e-mentor now covers a much broader scope of topics. Issues related to the presence of ICT in education are no longer limited to e-learning at the academia. Any form of TEL, formal or informal, along with its lifelong dimension fits with the present scope of the journal. Teaching methods and programs could also be taken into consideration as well as the challenges that digital technology brings to the lives of individuals and the whole communities or businesses.

ACCEPTED PAPERS

The journal welcomes original works based on the authors own scientific investigations. The papers may represent a variety of theoretical perspectives and different methodological approaches. They may rest on the full spectrum of established methodologies, from laboratory experiments to field observations. The main criteria in review and selection process concern the significance of the contribution to the area of tertiary education as well as business and knowledge management with special emphasis on the role of ICT in those areas.

ADDITIONAL TIPS

Before submitting the file please make sure that:

- The abstract and relevant keywords are included
- All references mentioned in the Reference List are cited in the text, and vice versa
- All illustrations and graphs list their source, even if they are created by the author
- Permission has been obtained for use of copyrighted material from other sources (including the internet)
- Biographical notes and photographs of every author are added
- Manuscript has been 'spell checked' and 'grammar checked'

Detailed tips are published on the website:

http://www.e-mentor.edu.pl/eng/page/8/Info_for_Authors

The materials contained in „e-mentor” journal are subject to copyright protection. Any text or its fragment may be reprinted solely upon the agreement of the Editors. The Editors reserve the right to shorten or make changes to unsolicited materials.



SGH

Warsaw School
of Economics

SGH shapes leaders

We offer full-time studies in English

First-cycle programmes:

- Global Business, Finance and Governance
- International Economics
- Management
- Quantitative Methods in Economics and Information Systems

Second-cycle programmes:

- Advanced Analytics – Big Data
- Finance and Accounting with ACCA Qualification
- Global Business, Finance and Governance
- International Business

www.sgh.waw.pl/admission

