デジタル・ディバイド再考
─情報の量と理解の間から

工 藤 裕 子[†]

Rethinking Digital Divide:
From the Differences between Information Volume
and Its Understanding

Hiroko Kudo

The paper examines the difference between access to information and levels of understanding it, in relation to cognitive issues, in order to understand the issues of digital divide.

The research results suggest that guaranteeing citizen the access to information does not necessary mean that they understand it, because of cognitive constrains, according to the cognitive load theory. Digital divide, thus, would not be overcome just because information would be provided.

The paper investigates the gap between having information and understanding it, especially when the information is presented in different ways, in order to reconsider its implications for digital divide issues.

Key Words: Digital Divide, transparency, complexity, cognitive load theory, processing fluency.

1. What is Digital Divide?─Definition and Critique

What is digital divide? There have been and are various definitions; however some were already overcome mostly due to technological changes and advancements, partially thanks to efforts carried out by various actors. Here are some definitions and observations on them worth considering (emphasised in *italics* by the author).

The term "digital divide" refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities [26].

The concept of the digital divide keeps evolving and broadening with new technological developments: some studies have looked into further digital divides emerging among internet users who

---

[†] 中央大学法学部教授，Professor, Faculty of Law, Chuo University

use multiple mobile devices like tablets and smartphones to access the internet. (…) as digital technologies continue developing, some users embrace them and enhance their online experiences, while others have a limited internet use or do not use the technology at all [11].

In part the digital divide is about differential access to hardware. In this sense, the digital divide is a simple extension of the century-old goal of "universal service" (…) Another aspect of the digital divide refers to software and the uses of information technology. (…) Still another aspect of the digital divide refers to access to the full range of services through the consumer's network connection, and is called the "equal access" issue. (…) The presence of gaps in access and usage of IT among various socioeconomic groups... [25]

The gap between those who have access to digital technologies and those who do not; or the gap between those who use digital technologies and those who do not understood in binary terms *distinguishing the* "*haves*" *from the* "*havenots*". (…) I offer a refined understanding of the "digital divide" to include a discussion of different dimensions of the divide focusing on such details as quality of equipment, autonomy of use, the presence of social support networks, experience and online skill [15].

…the 'digital divide' is originally and persistently plural. This plurality has at least two consequences. First, *there is not one digital divide*; there is a constellation of different and intersecting social, economic, and technological differences, all of which are properly named 'digital divide'. (…) Second, despite the value placed on consistent and precise use of terminology, lexical multiplicity is not necessarily a deficiency. *It is not always a semantic problem to be resolved by prescribing, even provisionally, a univocal and noiseless definition*. Because IT has evolved at historically unprecedented rates, the various problems that are associated with it also experience accelerated change. This is one reason for the variability in the NTIA reports. *The changing definition of the digital divide is not the result of capriciousness or an inability to be precise. It has varied because the technology in question has changed considerably* [14].

But viewed analytically, there is not one, there are three digital divides—and emerging in many nations a fourth. The first divide is that which exists within every nation, industrialized or developing, between those who are rich, educated, and powerful, and those who are not. (…) A second digital divide, less often noted, is linguistic and cultural. (…) The third digital divide follows inevitably from the first two—it is the growing digital gap between the rich and the poor nations. (…) The critical question about the fourth digital divide, however, is whether the prosperity of this new digital elite spreads to the rest of society, especially to urban poor and to rural villagers, or whether it creates an increasingly separate, cosmopolitan, knowledge-based enclave. (…)

The point is that "the digital divide" is really at least four divides, all closely related. The first is internal, between the digitally empowered rich and the poor. (…) The second linguistic-cultural gap is largely between English and other languages, or more generally, between "Anglo-Saxon culture" and other world cultures. The third is the gap exacerbated by disparities in access to information technology between rich and poor nations. Finally, there is the emergent intra-national phenomenon of the "digerati", an affluent elite characterized by skills appropriate to information-based industries and technologies, by growing affluence and influence unrelated to the traditional sources of elite status, and by obsessive focus, especially among young people, on cutting edge technologies, disregard for convention and authority, and indifference to the values of traditional hierarchies [20].

…the digital divide refers to social stratification due to unequal ability to access, adapt, and create knowledge via use of information and communication technologies (ICT) [43].

The theory of diffusion of innovations provides an adequate framework to classify the diverse methodological approaches that have been taken to study the digital divide. (…) four perspectives on the digital divide. Two of them are concerned with the type of node: (…) The other two concern the diffusion of innovation: (…) [16]

As Gunkel (2003) puts it; "critical examinations of the digital divide appear to be in short supply. The few commentaries that have been published are little more than reactions and editorials which argue, mainly through anecdotal evidence and personal opinion, that the divide is a myth (Brady, 2000; Cohen, 2000), political hyperbole (Horvath, 2000), bunk (Somerson, 2000), non-existent (Thierer, 2000), or rubbish (Crabtree, 2001). What is needed, therefore, is neither uncritical adherence to, nor simple reaction against, the digital divide but a critique that exposes and investigates the problems inherent in both"[14]. The paper refers to myth, but does not take the stance above mentioned; as European Parliament, even based on a recent redefinition of 2015, still focuses to improve broadband connectivity and internet usage through funding and regulation, that is, targets on infrastructure and skill, the paper tries to offer a critical and different approach to digital divide, mainly through theoretical analysis, supported by exploratory experiments.

The paper focuses on the gap between citizens' access to information, which is often considered as crucial issue for the digital divide discussion, and their levels of understanding it, in relation to transparency and cognitive issues. Research suggests that the effects of transparency on understanding depend upon the way information is presented: more detailed content will negatively affect understanding and this negative affect will be stronger when the information is structurally fluent.

This is a conceptual paper with extended literature review, given the characteristics of its research questions: how differs "understanding information" from "having information"; and how the presenta-

tion of information affects understanding. In order to verify the hypothesis delivered from the literatures, a reinterpretation of an existing experiment and a small scale testing were carried out. The results of both literature review and experiment demonstrate that effects of transparency on information understanding are heavily dependent upon presentation—citizens exposed to more detailed information understand the information worse than those exposed to less detailed information. This relationship is strengthened when the information is structurally fluent. These research results suggest that guaranteeing citizen the access to information does not necessary mean that they understand it, because of cognitive constrains, according to the cognitive load theory [38]. The paper investigates the gap between having information and understanding it, in order to contribute to the discussion on digital divide from an unconventional perspective.

2.   Theoretical Analysis on Transparency, Information and Understanding

Transparency has long been extolled as means of ensuring that public institutions function effectively [18]. This is because transparency constitutes a key means of reducing information asymmetries between government and the public [37]. By reducing information asymmetries, transparency can empower citizens to better understand what their government is doing, thus permitting them to make decisions that more closely reflect their best interests and, in turn, fostering more accountable and responsive public organizations [12][17][30].

Many literatures have begun to examine the extent to which transparency is actually capable of achieving the goals often attributed to it [29]. Findings of these studies have helped to advance understanding of transparency by offering greater insight into how transparency relates to constructs such as trust in government [2][13][8]. However, despite these contributions, the field still lacks direct insight into how transparency affects citizens' understanding of government [7]. Throughout the literature, transparency's ability to improve citizens' understanding of government is often assumed [10]. We indeed know very little about how transparency works because we do not know how transparency shapes citizens' understanding of their government and how this understanding in turn bears upon outcomes of interest such as trust in government.

3.   Cognitive Limitations on Understanding—Literature Review

Citizens are said to possess an imperfect understanding of how they benefit from public policies [22]. While transparency is proposed as a means of enabling citizens to better understand the benefits associated with a particular policy, expanding access to relevant information is only part of a broader solution to improving citizens' understanding of the benefits associated with public policies. In addition to improving citizens' access to relevant information, government must also work to ensure that policy information is understandable to a broad spectrum of the public [30]. To do so, one must consider methods of presentation that are conducive to effective processing, understanding, and use of the complex information citizens are exposed to [35][9][10]. Along these lines, literature from different

areas of psychology offers insight into presentation strategies that can attenuate cognitive constraints and, in turn, bolster policy understanding. The paper draws upon insights offered by cognitive load theory (educational psychology) and processing fluency (consumer psychology).

Cognitive load theory explains that as the level of mental effort needed to process information increases, individuals' ability to understand the information embedded in the message decreases [38]. Research on the determinants of mental effort has identified two factors as being of particular importance-structure of the message and complexity of the message [4]. Specifically, what this research illustrates is that messages that tend to be more complex and poorly structured increase levels of mental effort that must be expended in order to understand the message and, as a result, detract from understanding [39]. Therefore, reducing complexity and improving the structure of messages communicating government information are two methods that may improve citizens' understanding of information, which might draw new insights into digital divide discussion.

3.1 Complexity

Complexity of a message is typically mitigated via two forms of omission [42]. The first form of omission entails reducing the quantity of information embedded in a single message [39]. While reducing the amount of information can detract from an individual's ability to understand the issue in a comprehensive sense, it does increase the likelihood of them better understanding the limited information they are exposed to [3]. However, from a perspective of government transparency, this strategy is problematic because it may detract from the public's ability to comprehensively understand a particular policy. Furthermore, and perhaps more importantly, this approach can also conflict with legal obligations that govern public disclosure. For these reasons, the second form of omission, which relates to reducing the level of detail with which the information embedded in the message is discussed, is preferred [21]. The assumption is that foregoing specific facts and figures when presenting new information will allow individuals to better focus their attention on the salient information in the message [6]. That is, using less detailed language allows individuals to exert less mental effort when processing the message and, therefore, improve their understanding of the information in the message [1].

3.2 Structure

The concept of processing fluency from consumer psychology provides a framework for understanding how the structure of a message can be manipulated in order to reduce cognitive load and facilitate citizens' ability to understand public policy [33][45]. Processing fluency research has identified a number of ways in which the structure of a message can be altered in order to help audiences better understand the information they are exposed to [33][19][36]. Across the different manipulations, a common theme is that they all attempt to alter, in one way or another, the clarity with which information is presented, by for example, altering letter fonts or breaking a message into bullet points. Yet, de-

spite the variety of processing fluency manipulations, an important observation is made by Rennekamp (2012), who notes that, irrespective of the range of methods used to improve the structure of a message, "the corresponding responses from individuals are remarkably similar across different settings" [34]. Specifically, improving the structure of a message to enhance clarity of presentation, irrespective of the precise manner in which it is done, is generally found to improve individuals' ability to process and, ultimately understand, the information they are exposed to [24].

4. Complexity and Structure of Information—Cognitive Load Theory and Processing Fluency Literature

Fung, Graham, and Weil (2007) caution that, because transparency is critical to enhancing citizens' understanding of government, governments must find ways of presenting the information so as to avoid overloading citizens with information and evoking 'policy confusion' [27][12]. Cognitive load theory and processing fluency literature offer methods of attenuating information overload in order to ensure that citizens understand the government information they are exposed to. Among these methods, two have been identified as being of immediate relevance to the purposes of this study—detail and structure [19][5][34].

The logic underlying these initiatives is that more detailed accounts of government actions make it more difficult for citizens understand what government is doing. This is because greater mental effort must be exerted in order to process the detailed information being presented to them [27][24]. Prat (2005) adopts a game theoretic perspective to illustrate this point [32].

Prat explains that, due to cognitive constraints, an agent can overwhelm the principal by burying a message's signal in lots of highly detailed information [23]. Research related to cognitive load theory, echoes the sentiments expressed by Prat (2005), while also providing empirical illustrations. This line of research demonstrates across a variety of settings how different methods of enhancing the complexity of a message through, for example, the inclusion of more detailed information (facts and figures) consistently makes the message more difficult to understand [40][41]. The reason for this is that increasing the complexity of a message bolsters the mental effort needed to make (comprehensive) sense of the different pieces of information embedded in the message. Conversely, reducing the complexity of a message by using less detailed language can mitigate cognitive constraints, thereby increasing the likelihood that citizens will be able to understand the information they are exposed to.

In line with discussions of information overload, more detailed descriptions of a policy are likely to make it more difficult for citizens' to process the information and, consequently, detract from their levels of understanding. Therefore, in order to improve citizens' levels of understanding, government information that discusses policies in more general terms is likely preferred in that it is simpler, provided it offers an accurate overview of a policy.

A second important means of improving citizens' understanding of a public policy is to ensure that information is structured effectively. Here, structure is understood as the organization of information

within a message [40]. Ensuring effective structure means the content of a message is organized in a way that reduces the mental effort needed to pick out key points embedded in the message [36]. As mentioned, there are numbers of presentation methods used to enhance structural fluency [33]. However, one common method of enhancing the structural fluency of a message is to organize content in a message into smaller distinct issue-specific elements [28][39]. Bracketing content in this way results in consumers of the information exerting less mental effort when attempting to identify and consequently process salient aspects of the message [41]. By improving the structural fluency of a message in this way, individuals can allocate a greater proportion of mental effort to interpreting signals in a message and spend less time sifting through noise in the message to identify signals of interest. As such, the effect of policy transparency on policy understanding will be stronger when the structural fluency of the government information outlining the policy is high.

5. Validation—Reinterpretation of Experiment, Test, and Findings

Due to financial constrain to tailor a large-scale scenario-based survey for this research, the paper analyses and reinterprets an existing experiment conducted by Porumbescu and his team (2016) in a different setting with different focus and objectives, but with somewhat similar ideas, that is to analyse relationship between information and understanding, although the original research focused on impact of policy transparency on citizens' levels of policy understanding and support for a hypothetical policy [31]. The survey affords generalizable insight into how level of detail and processing fluency of information government presents to citizens affect their ability to understand the information they are presented with.

The original experiment was carried out in order to test the hypothesis that more detailed content will negatively affect understanding and this negative affect will be stronger when the information is structurally fluent [31]. The survey was conducted on a nationally representative panel of 510 US citizens. All subjects were presented with the same general information about a hypothetical policy. At the beginning of the experiment, subjects were provided with instructions and a brief description of the experiment. After agreeing to participate in the survey, subjects were then randomly assigned to one of four policy transparency treatment groups. Each of the treatment groups explained the same policy but differed in the way the information was structured and the level of detail the policy was discussed in. After being subjected to a treatment, all subjects were then directed to respond to the same survey.

Policy understanding was analysed through its two dimensions. The first dimension focuses upon subjects' objective policy understanding; subjects were asked a series of nine multiple-choice questions pertaining to the policy prompt they read in order to gauge their level of objective understanding. Their responses were summed in order to create an additive index, where a score of nine corresponded to the highest possible level of objective understanding and a score of zero corresponded to the lowest possible level of objective policy understanding. The second dimension assesses subjects' sense of understanding. While objective understanding is conventionally said to play an important role in informing individuals behaviours and attitudes, feelings-as-information theory argues that an individual's

sense that they understand a particular issue (or information they have read pertaining to said issue) also plays a critical role in shaping individual behaviours and attitudes pertaining to said issue [36]. Citizens' objective and subjective understanding of a policy both must be accounted for when attempting to explain the relationship between transparency, understanding, and voluntary policy compliance. Subjective understanding is measured using two items. The first item asked subjects to evaluate their level of policy understanding using a seven-point Likert scale (1: did not understand at all; 7: understood very well). The second item asked respondents how many general questions out of seven they believe they would be able to answer correctly (1: none correct; 8: all correct). Responses to both items were first standardized then averaged.

The results suggest that providing citizens with more detailed information about a policy does not necessarily detract from the public's ability to understand that policy. While greater detail did not affect individual's actual understanding of the material they were exposed to, it did negatively affect respondents' perception that they understood the material they were exposed to. Regarding the impact of structure, providing participants with more detailed information decreased their understanding of the policy only when the information was fluent. To the contrary, varying the level of information detail did not significantly affect participants' understanding of the policy when the information was presented in a dis-fluent manner.

The results of the experiments seem to support the following hypothesis: 1) exposure to more detailed information about a policy decreases policy understanding; and 2) information fluency will moderate the negative effect of information detail on policy understanding, such that the negative effect of information detail on policy understanding will be stronger when the information is structurally fluent and weaker when the information is structurally dis-fluent.

In order to check the validity of the experiment in different culture settings, the author conducted a test, which was designed after the above mentioned experiment, with the policy issue and its statements modified to fit for the Japanese participants. The test was conducted in February 2017 with a participation of 35 students. Because of its small size of the participants, the statistical validation of the results is rather poor; however the responses clearly confirmed the above mentioned hypothesis. Indeed, who read more detailed information understood less about the issue than those who read less detailed information. Also the way the information was stated influenced the understanding. This test has another crucial limitation, which is the homogeneity of the participants, that is, all 35 students were freshmen of the Faculty of Law of Chuo University and registered to the seminar of the author. Thus, a further and tailored experiment of a certain scale would be necessary to validate the Porumbescu experiment in the context of digital divide as well as in different cultural settings.

6. Conclusion―Limitation and Contribution

Although the validation of the results of theoretical analysis relies on a reinterpretation of an existing experiment and on a small scale test, thus exposed to various limitations above mentioned, the lit-

erature review and the results of the experiment draw interesting insights, which fundamentally affect the conventional discussion on digital divide.

Exposure to more detailed information does not seem positively influence the understanding and this means that providing infrastructures and skill to access information, which is one of the most popular policy recommendations related to digital divide, is not enough to improve citizens' understanding.

One contribution of this paper stems from the insight it provides into the role presentation plays in shaping the impact on understanding. What is becoming increasingly apparent is that simply making more information available is, in itself, not enough to bring about a more informed and understanding citizen. Rather, for transparency to bolster citizens' understanding, steps must be taken to ensure that information is being presented to citizens in ways that they can use it.

Then, what would be the implications of the results of this research for the digital divide discussion? Much of the existing work on digital divide tends to focus exclusively on importance of ensuring access to information. The findings of this research offer evidence to suggest that having access to detailed information is not the ultimate solution, but how the information is provided plays an important role in improving the understanding of information, which is the crucial issue for the citizen. Thus, guaranteeing infrastructure, hardware, software, and maybe education to enhance skill are not enough for better understanding, but presenting information in easy-to-understand way. Indeed, the way information is presented to the public is just as important as the information itself. Some methods of communicating information are much more effective at enhancing understanding than others. This would be an interesting hint as well as important contribution to the current digital divide discussion.

The difference between having information and understanding it, and between the information volume and understanding, and the various issues related to understanding are connected to further crucial topics such as Big Data in public policy and management. Thus the research is not only relevant to the digital divide discussion, but also to various issues of e-governance and digital governance.

References

[1] Ayres, P., 2006. Using subjective measures to detect variations of intrinsic cognitive load within problems, *Learning and Instruction*, 16(5): 389–400.

[2] Benito, B. and Bastida, F., 2009. Budget transparency, fiscal performance, and political turnout: An international approach, *Public Administration Review*, 69(3): 403–417.

[3] Blayney, P., Kalyuga, S. and Sweller, J., 2015. Using cognitive load theory to tailor instruction to levels of accounting students' expertise, *Journal of Educational Technology & Society*, 18(4): 199–210.

[4] Chandler, P. and Sweller, J., 1991. Cognitive load theory and the format of instruction, *Cognition and Instruction*, 8(4): 293–332.

[5] Clark, R. C., Nguyen, F., Sweller, J. and Baddeley, M., 2006. Efficiency in learning: Evidence based guidelines to manage cognitive load, *Performance Improvement*, 45(9): 46–47.

[6] Cook, M. P., 2006. Visual representations in science education: The influence of prior knowledge and cognitive load theory on instructional design principles, *Science Education*, 90(6): 1073–1091.

[7] Cook, F. L., Jacobs, L.R. and Kim, D., 2010. Trusting what you know: Information, knowledge, and confidence in social security, *The Journal of Politics*, 72(02): 397–412.

[8] De Fine Licht, J., 2014. Policy area as a potential moderator of transparency effects: An experiment, *Public Administration Review*, 74(3): 361–371.

[9] Eppler, M. J. and Mengis, J., 2004. The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines, *The Information Society*, 20(5): 325–344.

[10] Etzioni, A., 2010. Is transparency the best disinfectant? *Journal of Political Philosophy*, 18(4): 389–404.

[11] European Parliament, 2015, *Briefing—Bridging the digital divide in the EU*, http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/573884/EPRS_BRI%282015%29573884_EN.pdf

[12] Fung, A., Graham, M. and Weil, D., 2007. *Full Disclosure: The Perils and Promise of Transparency*, Cambridge University Press: Cambridge.

[13] Grimmelikhuijsen, S. G. and Meijer, A. J., 2014. The effects of transparency on the perceived trustworthiness of a government organization: Evidence from an online experiment, *Journal of Public Administration Research and Theory*, 24(1): 137–157.

[14] Gunkel, D. J., 2003. Second thoughts: Toward a critique of the digital divide, *New Media & Society*, 5(4): 499–522.

[15] Hargittai, E., 2003. The digital divide and what to do about it, in Jones, D. C., ed., *New Economy Handbook*, San Diego, CA: Academic Press, pp. 822–841.

[16] Hilbert, M., 2011. The end justifies the definition: The manifold outlooks on the digital divide and their practical usefulness for policy-making, *Telecommunications Policy*, 35(8): 715–736.

[17] Hood, C., 2010. Accountability and transparency: Siamese twins, matching parts, awkward couple? *West European Politics*, 33(5): 989–1009.

[18] Hood, C., 2006. Beyond exchanging first principles? Some closing comments, in Hood, C. and Heald, D., eds., *Transparency: The Key to Better Governance?*, pp. 211–226. Oxford, UK: Oxford University Press.

[19] Janiszewski, C. and Meyvis, T., 2001. Effects of brand logo complexity, repetition, and spacing on processing fluency and judgment, *Journal of Consumer Research*, 28(1): 18–32.

[20] Keniston, K., 2003. Introduction: The four digital divides, in Keniston, K. and Kumar, D., eds., *The Four Digital Divides*, Sage Publishers.

[21] Kirschner, P. A., 2002. Cognitive load theory: Implications of cognitive load theory on the design of learning, *Learning and Instruction*, 12(1): 1–10.

[22] Koch, J. and Mettler, S. 2012. Who Perceives Government's Role in Their Lives, Assessing the Impact of Social Policy on Visibility. Working paper.

[23] Mansbridge, J., 2009. A "Selection Model" of political representation, *Journal of Political Philosophy*, 17(4): 369–398.

[24] Miele, D. B. and Molden, D. C., 2010. Naive theories of intelligence and the role of processing fluency in perceived comprehension, *Journal of Experimental Psychology: General*, 139(3): 535–557.

[25] Noll, R. G., Older-Aguilar, D., Rosston, G. and Ross, R. R., 2000. The Digital Divide: definitions, measurement, and policy issues, paper presented at Bridging the Digital Divide: California Public Affairs Forum, Stanford University.

[26] OECD, 2001, *Bridging the digital divide*, https://www.oecd.org/site/schoolingfortomorrowknowledgebase/themes/ict/bridgingthedigitaldivide.htm

[27] O'Neill, O. 2002. *A Question of Trust: The BBC Reith Lectures 2002*. Cambridge, UK: Cambridge University Press.

[28] Paas, F., Renkl, A. and Sweller, J., 2003. Cognitive load theory and instructional design: Recent developments, *Educational Psychologist*, 38(1): 1–4.

[29] Piotrowski, S. J., 2014. Transparency: A regime value linked with ethics, *Administration & Society*, 46 (2): 181–189.

[30] Porumbescu, G. A., 2015. Using transparency to enhance responsiveness and trust in local government can it work? *State and Local Government Review*, 47 (3): 205–213.

[31] Porumbescu, G. A., Bellé, N., Cucciniello, M. and Nasi, G., 2016. Translating policy transparency into policy understanding and policy support: Evidence from a survey experiment. Working paper.

[32] Prat. A., 2005. The wrong kind of transparency, *The American Economic Review*, 95(3): 862–877.

[33] Reber, R., Winkielman, P. and Schwarz, N., 1998. Effects of perceptual fluency on affective judgments, *Psychological Science*, 9(1): 45–48.

[34] Rennekamp, K., 2012. Processing fluency and investors' reactions to disclosure readability, *Journal of Accounting Research*, 50(5): 1319–1354.

[35] Simon, H. A., 1982. *Models of bounded rationality: Empirically grounded economic reason* (Vol. 3), MIT press: Cambridge.

[36] Song, H. and Schwarz, N., 2008. Fluency and the detection of misleading questions: Low processing fluency attenuates the Moses illusion, *Social Cognition*, 26(6): 791–799.

[37] Stiglitz, J. E., 1999. Reforming the global economic architecture: lessons from recent crises, *The Journal of Finance*, 54(4): 1508–1522.

[38] Sweller, J., 1998. Can we measure working memory without contamination from knowledge held in long-term memory? *Behavioral and Brain Sciences*, 21(06): 845–846.

[39] Sweller, J., 2010. Element interactivity and intrinsic, extraneous, and germane cognitive load, *Educational Psychology Review*, 22(2): 123–138.

[40] Sweller, J. and Chandler, P., 1994. Why some material is difficult to learn, *Cognition and Instruction*, 12(3): 185–233.

[41] Van Merriënboer, J. J. and Sweller, J., 2005. Cognitive load theory and complex learning: Recent developments and future directions, *Educational Psychology Review*, 17(2): 147–177.

[42] Van Merriënboer, J. J. and Sweller, J., 2010. Cognitive load theory in health professional education: Design principles and strategies, *Medical Education*, 44(1): 85–93.

[43] Warschauer, M., 2011, A literacy approach to the digital divide, *Cadernos de Letras* (*UFRJ*), n. 28: 5–18.

[44] Winkielman, P., Schwarz, N., Fazendeiro, T. and Reber, R., 2003. The hedonic marking of processing fluency: Implications for evaluative judgment, in Musch, J. and Klauer, K. C., eds., *The psychology of evaluation: Affective processes in cognition and emotion*, Lawrence Erlbaum Associates, Inc., Publisher, pp. 189–217.