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Abstract

Readers' ability to critically evaluate the contents they read online is a core literacy skill. One way to evaluate contents is the assessment of source dimensions (i.e., sourcing). An increasing amount of data suggests that sourcing is a challenge for teenagers (e.g., Potocki et al., 2019). This may be related to the development of advanced theory of mind (TOM²), which extends throughout childhood and into adolescence (Miller, 2009). The present study examined the role of TOM² in teenagers' source evaluation skills. After controlling for basic reading abilities, TOM² abilities was moderately but significantly related to specific dimensions of multiple document comprehension, i.e., the evaluation of sources' expertise and benevolence. Implications for teenagers' literacy acquisition are discussed.

Keywords: Advanced theory of mind; Sourcing; Adolescence

Introduction

Readers' ability to critically evaluate the contents they read online is a core literacy skill. Evaluation while reading can be based on one's prior knowledge of the content read, or on one's assessment of source dimensions such as the author's expertise or trustworthiness (Richter & Maier, 2017; Scharrer & Salmerón, 2016). The later has been called “Sourcing” and may be seen as an umbrella word that refers to a range of cognitive activities directed to the source of information (Scharrer & Salmerón, 2016). In simple words, information can be evaluated by examining its source, and sourcing involves paying attention to a range of source parameters such as expertise, benevolence, and type of media (e.g., Forzani, 2020; Pérez et al., 2018). In a society of shared cognitive labor, it is less important to master every piece of human knowledge than to know whom to trust (e.g., Bromme & Goldmann, 2014). Online information can then be subjected to "second-hand evaluation" (e.g., Sharon & Baram-Tsabari, 2020), be "believed by delegation" (Bronner, 2003) or get granted by some "cognitive authority" (Rieh, 2002).

An increasing amount of data suggests that sourcing is a challenge for teenagers (e.g., Potocki et al., 2019). The challenge may be related to a number of dimensions of cognitive development and schooling, including teenagers' knowledge about sources (Potocki et al., 2019), their awareness of when and why source evaluation should matter (Paul et al., 2017), and the development of their beliefs about knowledge and learning (Barzilaï & Stromso, 2018). As argued by Britt et al. (2019) we need developmental data to understand what is required for a given population to deal with fake news. In order to design adequate instructional interventions, it is important to understand the factors that affect teenagers' ability to understand and make use of source information.

Part of teenagers' evaluation of information sources depends on their ability to understand who knows what and who wants what about a situation. This, in turn, may be related to the development of a theory of mind, which extends throughout childhood and into adolescence (Miller, 2009). Advanced forms of theory of mind enable one to understand what someone else believes about a third person's knowledge ("second-order" theory of mind; Desgranges et al., 2013). Theses advanced forms has also been called “interpretative theory” of mind and are considered as being a likely precursor of understanding sources’ perspectives (Barzilai & Weinstock, 2020).

Advanced theory of mind has been found to explain multiple text comprehension skills in fifth graders (Florit et al., 2020). Nevertheless, the assessment task used by Florit et al. (2020) required participants to read and understand a text, which could have overdetermined their results. For this reason, it is still unclear whether theory of mind contributes to multiple text comprehension independently from reading skills.

In the present study, we use the term “TOM²” to refer to a reader's perception of a character's awareness of another character's state of mind. We examined the role of TOM² in teenagers' source evaluation skills. We hypothesized that after controlling for basic reading abilities, TOM² abilities would predict specific dimensions of multiple document comprehension, i.e., the evaluation of sources' expertise and benevolence.

Method

Participants

The participants were 54 French eighth grade students at a semi-urban middle school. 9 students were excluded from the analysis because of either a reported developmental condition (autism, dyslexia) or too many missing answers. The final sample included 45 students (*M* age = 13.6, 28 female).

Materials

All the materials were presented on a computer screen through the SELEN[1] website designed for that purpose.

Multiple documents reading tasks.

We created two sets of online documents (e.g., pseudo-website pages or forums) that we implemented into the SELEN website. The document sets (approximately 1550 words each - Flesch-Kincaïd 5,6 and 5,7) dealt with two fictitious controversies regarding social-technological issues. The documents were presented together with comprehension, evaluation, and sourcing questions. Comprehension and evaluation question were both in a multiple-choice format and open, whereas Sourcing questions involved rating the knowledgeability and trustworthiness of document authors, forum, or blog contributors on 10-point Likert scales.

Theory of mind assessment. We used the "TOM15" (Desgranges et al., 2013), a set of tasks that assess basic and advanced theory of mind through seven short picture-based narrative scenarios. Compared with other, text-based ToM tasks, this task is expected to be less related to participants' reading ability. For each scenario, participants were asked a control comprehension question and a false belief question ("what does X think that Y believes"). One score point was

[1] https://selen.huma-num.fr/selen_training/public/

granted if participants correctly responded the two questions, resulting in a TOM² score between 0 and 7.

Word reading assessment. We also assessed the participants' word reading skills using through a set of three tasks that required participants to assess the orthographic, phonological, or semantic similarity among word pairs. Participants' scores were a ratio of time spent per correct item, collapsed across subtasks.

Procedure

The participants were run in two sessions at a three-week interval. In each session, the multiple document comprehension task was organized in three "episodes" focused on comprehending the information, reflecting on the situation, and evaluating the sources, respectively. The contents of the document sets were balanced across student groups. The TOM² and word reading assessment tasks were assigned separately, as part of each session.

Note that the experiment initially involved a "prompting" manipulation, which failed to yield a main effect or interaction and is no longer reported in the results section.

Evaluation questions collapsed across sets yielded a good internal consistency ($N = 10$; $\alpha = .817$). However, the Comprehension and Sourcing questions failed to provide a reliable index and they won't be further considered in this presentation.

Results

Descriptive statistics

Table 1 presents the descriptive statistics for the tasks involved in the experiment. None of the tasks yielded floor or ceiling effects and the distributions were normal or close to normal. Of special interest is the participants' relatively modest performance on the TOM² task, which merely required to identify what a story character believes about another character's knowledge of a shared situation.

Table 1. Descriptive statistics for the tasks involved in the experiment.

	TOM^2	Lexical quality composite score	Multiple-text evaluation questions
Mean	4.73	206	3.41
SD	1.70	43.6	2.45
Observed max.	7	327	9
Observed min.	1	112	0
Max. possible	7	/	9

Correlations

Table 2 Shows the Pearson correlations between the four main variables. All the variables were significantly correlated, enabling a multiple regression approach to our research question.

Table 2. Pearson correlations between the four main variables.

	1	2	3
1. TOM²			
2. Word reading	*r* = .363 *p* = .014		
3. MD evaluation question	*r* = .452 *p* = .002	r = .363 *p* = .014	

Linear regression

We conducted a multiple regression analysis to further examine the relationship between TOM² and our measures. A model including TOM² and lexical quality as predictor (R^2 = .250) for MD evaluation questions explained twenty-five percent variance of achievement ($F(2,42) = 6.99$; p <.014). In this model, only TOM² was significant (B = .215; p = .014) while lexical quality wasn't (B = .009; p = .118). Thus, TOM² influenced multiple document comprehension independently from basic word reading ability.

Discussion

The experiment aimed to examine the possible contribution of a measure of advanced theory of mind (TOM²) on teenagers' evaluation components of multiple text comprehension. The correlational analysis found that TOM² did predict evaluation and sourcing performance after controlling for word reading proficiency. This supports the broader view that teenagers' ability to comprehend multiple texts depends in part on their understanding of multiple

perspectives. Participants' performance on our measure of advanced theory of mind confirms that some 13 year-old students struggle to understand what a character beliefs about another character's knowledge of a situation (Miller, 2009), which may prevent them from assessing document authors' competency or trustworthiness.

The present study is limited because some of the materials were not sufficiently reliable to make up a complete assessment, and should be considered an initial exploration. Future studies should precisely delimit the implication of advanced forms of theory of mind while understanding multiple documents, and its respective implication on simple comprehension or most complicated inferential evaluation components. TOM² could also be related to epistemic cognition (Iordanou, 2016) and is likely to foster the ability of uncovering persuasive intentions by an accurate understanding of communicative intentions of documents. Finally, TOM² is probably related to sourcing abilities, by an accurate perception of competence and benevolence of documents sources. Another research perspective is to look for ways to promote evaluative skills in teenagers to prepare them for the independent evaluation of what they read on the Internet.

References

Barzilai, S., & Strømsø, H. I. (2018). Individual Differences In Multiple Document Comprehension. In J. L. G. Braasch, I. Bråten, & M. T. McCrudden (Éds.), *Handbook of Multiple Source Use* (1re éd., p. 99-116). Routledge. https://doi.org/10.4324/9781315627496-6

Barzilai, S., & Weinstock, M. (2020). *Beyond Trustworthiness : Comprehending Multiple Source Perspectives*. 32.

Britt, M. A., Rouet, J.-F., Blaum, D., & Millis, K. (2019). A Reasoned Approach to Dealing With Fake News. *Policy Insights from the Behavioral and Brain Sciences*, *6*(1), 94-101. https://doi.org/10.1177/2372732218814855

Bromme, R., & Goldman, S. R. (2014). The public's bounded understanding of science. *Educational Psychologist*, *49*(2), 59-69.

Bronner, G. (2003). *L'empire des croyances* (1re éd). Presses universitaires de France.

Desgranges, B., Laisney, M., Bon, L., Duval, C., Mondou, A., Bejanin, A., Fliss, R., Beaunieux, H., Eustache, F., & Muckle, G. (2012). TOM-15 : Une épreuve de fausses croyances pour évaluer la théorie de l'esprit cognitive. *Revue de neuropsychologie*, *4*(3), 216. https://doi.org/10.3917/rne.043.0216

Florit, E., De Carli, P., Giunti, G., & Mason, L. (2020). Advanced theory of mind uniquely contributes to children's multiple-text comprehension. *Journal of Experimental Child Psychology*, *189*, 104708. https://doi.org/10.1016/j.jecp.2019.104708

Forzani, E. (2020). A Three-Tiered Framework for Proactive Critical Evaluation During Online Inquiry. *Journal of Adolescent & Adult Literacy*, *63*(4), 401-414. https://doi.org/10.1002/jaal.1004

Iordanou, K. (2016). *From Theory of Mind to Epistemic Cognition. A Lifespan perspective*. https://doi.org/10.14786/FLR.V4I5.252

Miller, S. A. (2009). Children's understanding of second-order mental states. *Psychological Bulletin*, *135*(5), 749-773. https://doi.org/10.1037/a0016854

Paul, J., Macedo-Rouet, M., Rouet, J.-F., & Stadtler, M. (2017). Why attend to source information when reading online ? The perspective of ninth grade students from two different countries. *Computers & Education*, *113*, 339-354. https://doi.org/10.1016/j.compedu.2017.05.020

Pérez, A., Potocki, A., Stadtler, M., Macedo-Rouet, M., Paul, J., Salmerón, L., & Rouet, J.-F. (2018). Fostering teenagers' assessment of information reliability : Effects of a classroom intervention focused on critical source dimensions. *Learning and Instruction*, *58*, 53-64. https://doi.org/10.1016/j.learninstruc.2018.04.006

Potocki, A., de Pereyra, G., Ros, C., Macedo-Rouet, M., Stadtler, M., Salmerón, L., & Rouet, J.-F. (2019). The development of source evaluation skills during adolescence : Exploring different levels of source processing and their relationships / El desarrollo de las habilidades de evaluación de las fuentes durante la adolescencia: una exploración de los distintos niveles de procesamiento

de las fuentes y sus relaciones. *Infancia y Aprendizaje*, 1-41. https://doi.org/10.1080/02103702.2019.1690848

Richter, T., & Maier, J. (2017). Comprehension of Multiple Documents With Conflicting Information : A Two-Step Model of Validation. *Educational Psychologist*, *52*(3), 148-166. https://doi.org/10.1080/00461520.2017.1322968

Rieh, S. Y. (2002). Judgment of information quality and cognitive authority in the Web. *Journal of the American society for information science and technology*, *53*(2), 145-161.

Scharrer, L., & Salmerón, L. (2016). Sourcing in the reading process : Introduction to the special issue. *Reading and Writing*, *29*(8), 1539-1548.

Sharon, A. J., & Baram-Tsabari, A. (2020). Can science literacy help individuals identify misinformation in everyday life? *Science Education*, sce.21581. https://doi.org/10.1002/sce.21581