MITIGATING THE MATILDA EFFECT ON STARR ROXANNE HILTZ: A SUPERLATIVE EARLY ONLINE LEARNING RESEARCHER

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ABSTRACT

The *Matilda effect* refers to the systematic under-recognition of women's accomplishments in scientific fields (Rossiter, 1993), which we propose extends into additional fields coded male within our culture, such as educational technology and distance education. In the current paper, we attempt to reverse the Matilda effect by bringing to light the accomplishments of an early female online learning researcher, Starr Roxanne Hiltz, whose work spans the fields of information and computing technology, sociology, online learning, and beyond. We briefly review Hiltz's biographical background before exploring her major achievements, which include her 1978 publication of a seminal work, *The Network Nation*. Named the best technical-scientific publication of the year by the Association of American Publishers, *The Network Nation* is based on Hiltz's extensive research with one of the world's first computer conferencing systems and its use by academic scientific communities. This exploration of virtual communities, and in particular Hiltz's focus on their social-emotional and psychological elements (rather than technological affordances), was arguably the first research of its kind. Subsequent publications further explore computer-mediated communication, online communities, and online learning; in fact, Hiltz was the creator of the world's first functional "virtual classroom"—what we would now call a learning management system. We conclude that Hiltz's omission from histories of online learning, as well as standard textbooks and other works focused on distance education, provide evidence of the Matilda effect within this field.

Keywords: Unconscious bias, Matilda effect, women researchers, distance education, educational technology, computer-mediated communication, online learning

INTRODUCTION

Within the field of distance education, several theories may be considered foundational (Picciano, 2017). For example, Moore's (1997) transactional distance theory, Garrison et al.'s (2000) Community of Inquiry framework, and Knowles' (1984) adult education theory are all instantly familiar to students of distance education, and form the backbone of numerous courses and textbooks in this area (e.g., Anderson, 2008). It is intriguing to note, however, that this list—however expanded—is composed largely from the work of men.

Strikingly, prior to embarking on this project, this gender imbalance had never consciously been noticed by the authors: it is evidently so normalized that it was not even perceived as an indicator of the cultural power of the stereotype of the male scientist or researcher (Makarova et al., 2019; Miller et al., 2014; Nosek et al., 2009). This stereotype is related to numerous forms of unconscious bias. For example, both adults and children associate

1

brilliance or genius with men, rather than women, a finding hypothesized to partially account for the underrepresentation of women in fields such as philosophy or STEM (Storage et al., 2020). A second innate bias that may affect women's representation in the sciences is related their subjective self-evaluation of their performance, which inhibits women's ability to promote themselves to others (Exley & Kessler, 2019). In fact, by grade six, boys are better at self-promotion than girls are. This gender gap increases with age. Furthermore, by exuding self-confidence, men gain influence in an organization (Guillén et al., 2017). Women with equal qualifications, however, must display self-confidence *and* a pro-social (team-focused) attitude to obtain the same level of influence. Exploration of three theoretical explanations for "...women's limited self-promotion success: (1) cognitive dissonance, (2) stereotypical threat, and (3) backlash avoidance" (Lindeman et al., p. 219), leads to the conclusion that women actively avoid backlash. In other words, women do not engage in self-promotion for fear of social consequences.

A growing body of research shows that assessments of research impact are gendered (Chubb & Derrick, 2020), that female scientific researchers' papers are less likely to achieve acceptance by academic journals and less likely to be cited by others (Fox & Paine, 2019; Maliniak et al., 2013), and even that letters of recommendation written for equivalent candidates for academic jobs contain signals of doubt when written for women (Madera et al., 2019). In an exploration of the history of science, Rossiter (1993) coined the term *Matilda effect* to refer to this "sexist nature" of "women's systemic under-recognition" (p. 337). Rossiter named the Matilda effect for Matilda Gage (1826–1898), a suffrage writer and editor, as well as the author of *Woman as Inventor* (1870), a tract on women in the history of technology, and subsequent journal article, *Woman as an Inventor* (1883). In her own time, Gage observed that "the more [a] woman worked the more the men around her profited and the less credit she got" (Rossiter, 1993, pp. 336–337). In fact, Gage has been nearly forgotten today, making her a demonstration of the phenomenon that she described (Rossiter, 1993).

The lack of recognition of women's contributions to science in particular is profound. As Rossiter (1993) states, "not only have those unrecognized in their own time generally remained so, but others that were well-known in their day have since been obliterated from history, either by laziness or inertia, or by historians with definite axes to grind" (p. 328). Rossiter (1993) goes on to describe numerous women in virtually every scientific field—physics, chemistry, genetics, biochemistry, medicine and more—whose discoveries and innovations were suppressed, ignored, or attributed to their male collaborators. For example, Lise Meitner, who collaborated with Otto Hahn on the discovery of nuclear fission—one of the most important scientific discoveries of the twentieth century—was excluded from the Nobel Prize for this work, which went to Hahn alone (Rossiter, 1993).

As Lincoln et al.'s (2012) research demonstrates, the Matilda effect continues to exert influence on the perception of women's accomplishments in science; unconscious bias remains a salient issue across numerous academic fields. For example, the American National Science Foundation (NSF; NSF 2015a & b) statistics for 1994 to 2014 indicate that men hold more faculty positions in the social sciences, even though more women have PhDs. Bentley and Adamson (2004) concur with the NSF, going on to state that male domination increases among senior faculty positions, even when such factors as experience are taken into consideration. Given their close association with computing and digital technology, both of which are largely coded male within our culture (Makarova et al., 2019), it appears likely that distance education and educational technology are also impacted by the Matilda effect, thus shaping the perceptions of not only theorists—whose work is considered foundational—but also a gamut of stakeholders from policymakers, funders, and leaders to researchers, educators, and students.

With regard to this apparent male bias within distance education research, the aim of this

2

paper is to help reverse the Matilda effect for one online learning researcher in particular: Starr Roxanne Hiltz. Hiltz, a professor of sociology and computer and information science, conducted extensive early research on computer-medicated communication and online communities in the 1970s and created the world's first functional learning management system (Hiltz, 2017). Her vision, and her contributions to the field, were recognized in previous decades, but her work now largely appears to be forgotten. This paper focuses on Hiltz's essential contributions to the field. It begins with a brief review of her background and then explore her work in more depth, with a focus on her work on online communities and learning.

STARR ROXANNE HILTZ

Biographical Background

Starr Roxanne Hiltz was born in 1942 and graduated magna cum laude from Vassar in 1963 with a degree in sociology and economics (Hiltz, 2017). She went on to earn an MA and PhD in sociology (both from Columbia) before embarking on a career as a sociologist, research consultant, and ultimately, professor of sociology and then of computer and information science (Hiltz, 2017). She spent the latter part of her career (1985–2007) at the New Jersey Institute of Technology and is now a professor emerita, although she continues to publish and collaborate with others (Hiltz, 2017).

In many ways, Hiltz's career was shaped by the gendered expectations of women of her generation. For example, she married while still an undergraduate and selected a graduate school at which her husband could pursue the program of his choice; her graduate work was disrupted by her husband's pursuit of a military career and her relocation with him to a series of Army camps (Subramanian, 2013). Ultimately, she did complete her PhD in 1969. The gender roles and expectations of the day exerted a further effect on her career, when she discovered that the organization for which she had worked as a graduate student "really had no place for a woman" (Subramanian, 2013, p. 80). Even her boss, who was generally supportive, told her that he did not think she had a chance to succeed with the organization (Subramanian, 2013). In addition, Hiltz wished to have children, and there was no maternity leave available (Subramanian, 2013). Taking a substantial pay cut, Hiltz accepted a position at Upsala College, a small, private liberal arts college, where she became Chair of the sociology, anthropology, and social work department in 1973 (Subramanian, 2013).

In 1974, Hiltz began working with Murray Turoff, a computer scientist at the New Jersey Institute of Technology. Turoff had created a computer conferencing system and was looking for a sociologist to design experiments and study the communities who met and collaborated using the system (Subramanian, 2013). Hiltz and Turoff collaborated on a new version of the system, identifying what it would do, its social applications, and its pros and cons (Subramanian, 2013). Hiltz suggested that the new system be called EIES (Electronic Information Exchange System; pronounced "eyes,"); the name indicated that the system would encompass a "new way of seeing and perceiving the world" (Subramanian, 2013, p. 81). Hiltz obtained grant funding to study the scientific communities using similar tools, as well as grant funding for research communities to come and work on EIES (Hiltz, 1984; Hiltz & Turoff, 1978; Kerr & Hiltz, 1982).

The result of this early work was a ground-breaking book focused on emerging virtual communities. Written in collaboration with Murray Turoff (who provided input largely on the technological aspects), *The Network Nation*, published in 1978, was named the best technical-scientific publication of the year by the Association of American Publishers (Hiltz, 2017). In its time, the book was influential; it has been cited nearly 3000 times, according

to Google Scholar (see https://bit.ly/3w3EMWe). Subsequently, Hiltz continued to write and research in the areas of online communities, computer-mediated communication, and online learning (Hiltz, 2017); in fact, she conducted one of the earliest longitudinal studies of online communities. As mentioned above, she also conceived the notion of a virtual classroom, and designed and implemented the world's first functional learning management system (Hiltz, 2017). More recently, her work has focused on information systems for emergency management (Hiltz, 2017).

Subsequent sections of this paper explore Hiltz's early contributions to the field of online learning through a brief examination of four seminal publications: *The Network Nation* (1978), *Computer-Mediated Communication Systems* (1982), *Online Communities* (1984), and *The Virtual Classroom* (1994). The primary focus is on elucidating Hiltz's contributions in the area of online communities, which provide the foundation for her work on online learning.

The Network Nation

First published in 1978, and revised for a second edition in 1993, *The Network Nation: Human Communication via Computer* is a ground-breaking work. Based on Hiltz and Turoff's research with EIES and online scientific communities (as briefly described above), it explores the social and technical possibilities of what eventually became known as the Internet.

As explained in *The Network Nation*, the world's first computer conferencing system was created in 1970. The conferencing technology of the time was exclusively text-based (that is, digital images were not supported) and involved connecting via dialup from a terminal to a mainframe computer (Hiltz & Turoff, 1978). This early form of computer conferencing or computer-mediated communication, which the authors describe as "a new form of human communication utilizing the computer" (Hiltz & Turoff, 1978, p. xxv), is the focus of *The Network Nation*. In 2021, computer conferencing solely via text seems almost quaint or antiquated, but in 1978 it was so novel that it was necessary for Hiltz and Turoff to provide detailed explanations and drawings to explain it. As the authors state, "to participate in computerized conferencing, the members of a group type their written comments or contributions into a computer terminal attached to a telephone, which then transmits the material to the host computer" (p. xxvi).

At the time of writing, only "tens of organizations and a few thousand people" (Hiltz & Turoff, 1978, p. xxix) used this form of communication, which is unsurprising, given that the cost of a computer at the time was tens or hundreds of thousands of dollars—in 1978 dollars, no less (Hiltz & Turoff, 1978). The typical conception of a computer, at the time—even within the computer industry—was "something that sat in a large room with glass windows you couldn't get in to without a special access card" (Segaller, 1998). And yet the authors predicted that, in the future, computer-mediated communication would be "as omnipresent as the telephone" (p. xxv) and that an individual would be able to "work, shop, or be educated by or with persons anywhere in the nation or in the world" (p. xxix).

Written more than 25 years before the launch of Facebook—and in a time in which the idea of a home computer seemed like science fiction—Hiltz and Turoff (1978) describe a future in which:

> potentially intense communication networks among geographically dispersed persons will become actualized. We will become the Network Nation, exchanging vast amounts of both information and social-emotional communications with colleagues, friends, and "strangers" who share similar interests, who are spread out

4

all over the nation. Ultimately . . . these social networks facilitated by computer-mediated communications will become international. (p. xxix)

From the vantage point of 2021, the above comments seem almost eerily prescient; they provide an excellent description of social media or Web 2.0. In the developed world or Global North, the majority of us now take for granted the exchange of social-emotional communication, as well as information—but this conception was Hiltz's innovation. Her focus on human community, and on the sociological aspects of this new technology, were so far ahead of the curve that her early work was rejected by the *American Sociological Review* on the basis that "sociologists do not study computers" (Subramanian, 2013). In fact, Hiltz's work on virtual communities—based on her research of the scientific communities using EIES—was arguably the first of its kind (Hiltz, 2017; Subramanian, 2013). Certainly, the majority of the early creators and users of the Internet appear to have been focused on its technological affordances, not its sociological ones (Segaller, 1998).

Virtual Communities

Despite the limitations of the computer conferencing systems of the era, Hiltz and Turoff (1978) argue that they have "unique capabilities" (p. 8) to support group communication. These include a lack of time- and distance-related barriers, the ability to expand group sizes without decreasing individual participation, and the capability of members to participate in a rate and time of their own choosing (Hiltz & Turoff, 1978). While these affordances may be taken for granted in 2021, they were—as the authors describe—revolutionary in the 1970s, in which group communication of necessity could only take place face to face (technologies such as the telephone were seen as primarily suitable for one-on-one communication). In addition, against a backdrop in which the technical capabilities of a given system were the primary focus of computer scientists (Segaller, 1998), Hiltz's interest in and description of these and other social and psychological dimensions of computer-mediated communication were truly unique; she later described her early research in these areas as being like "an assault on the wilderness" (Kerr & Hiltz, 1982, p. 1).

The Network Nation identifies two particularly striking social and psychological aspects of computer-mediated communication, with the authors emphasizing that "in order to understand computer-mediated communications at all, you must see them as a social process" (p. 27). These are: impersonality, or "freedom to be oneself" (p. 27); and autonomy, or "user-determined rates and topics of information flow" (p. 29). Each is discussed below.

Impersonality

Hiltz and Turoff (1978) note that due to the restriction of communication channels in text-based computer conferencing—that is, a lack of visual cues, body language, vocal tone, and more—a degree of impersonality occurs in this form of communication. They observe that although "very warm and personal relationships can be fostered and maintained through this medium" (p. 27), computerized conferencing is:

> much less intimate and self-exposing than oral modes of communication in the sense that only your words (which can be carefully considered and edited) are transmitted. Your appearance or other personal characteristics (or handicaps) or other nonverbal cues need not be known. (p. 27)

The authors argue that this impersonality results in persons feeling "free to be extremely frank and open with one another, whether discussing a topic such as a scientific or business

5

problem, or in exchanging information about themselves and their feelings" (Hiltz & Turoff, 1978, p. 28). Such frankness and openness are seen as both advantageous and disadvantageous. The authors note that participants "can feel more free to express disagreements or suggest potentially unpopular ideas" (p. 27) and that "statements may be considered on their merit rather than by the status of their proponents" (p. 27). However, they note that participants' social and emotional needs are "not as likely to be met" as they are in a face-to-face meeting (p. 27).

One of the downstream implications of "freedom to be oneself" relates to group decision-making. The authors describe a series of earlier experiments that demonstrate "how high-status persons can easily convince a group to make a 'wrong' decision by dominating the discussion in face-to-face communication" (Hiltz & Turoff, 1978, p. 114). Hiltz and Turoff (1978) hypothesize that "the 'chilling effect' of rank on disagreement with a bad idea or decision advocated by a high-status person will not be as operative in computerized conferencing" (p. 114), although they note that their hypothesis was untested. Interestingly, subsequent studies have borne this out (e.g., Kimura & Tsuzuki, 1998), although researchers have also found that groups making decisions via CMC may become more polarized, particularly when operating with high degrees of anonymity (e.g., Sia et al., 2002). A recent Pew Research report echoes these findings (Rainie et al., 2017), and many of us have witnessed the polarizing political effects of siloed online communities.

Autonomy

Hiltz and Turoff (1978) describe the second striking social and psychological aspect of computerized conferencing as user-determined rates and topics of information flow (or autonomy). They state:

> Each participant in this form of communication chooses not only when and where to participate, but also whether to send or receive information at any specific time; at what rate the writing and reading (sending and receiving) will occur; and what topic this communication will concern. (Hiltz & Turoff, 1978, p. 29)

Once again, while this is largely taken for granted in 2021, it was novel (and revolutionary) in the 1970s. One of the implications of this is the fact that, in computer conferencing, "No one can be interrupted or shouted down" (Hiltz & Turoff, 1978, p. 29). In other words, the norms of turn-taking and holding the floor are disrupted in this form of communication (Hiltz & Turoff, 1978). Hiltz and Turoff (1978) describe new users within the EIES system experiencing "culture shock" (p. 81), as they recognize that the regulating mechanisms within face-to-face communication are completely altered within computer conferencing.

Hiltz and Turoff (1978) emphasize that this form of communication is a skill that must be developed. They describe "a new system of 'conventions and procedural rules' [that] emerges among participants, who must master them as well as the mechanics of the system before they feel comfortable and accomplished in this medium. Learning is a continuous process" (p. 82). The authors use a simple measure to demonstrate improvements in this skill: a chart with input rate of words per minute divided by how many hours a user has been in the system. The results demonstrate a four-fold increase in input rate from users with only 1 to 2 hours of experience to users with more than 64 hours of experience (from 6.4 words/minute to 27.7 words/minute).

In terms of qualitative improvement, Hiltz and Turoff (1978) state that amongst the more experienced users:

> the "written equivalent" of the language content tends to be somewhat better

organized and more fully thought out than comparable statements recorded from a face-to-face conversation. This is because the participant has a chance to take as long as desired to think about a response or comment, to reorganize and rework it until it presents the idea as fully and succinctly as possible. (pp. 82–83)

Intriguingly, this concept underlies much of the work around online communities of inquiry. As Garrison et al. (2000), in their seminal article proposing the community of inquiry theory, stated (more than 20 years after the publication of *Network Nation*):

Compared to traditional, oral classroom interaction, computer conferencing would appear to offer not only potential deficiencies, but also some advantages. One such advantage is that text-based communication provides time for reflection. For this reason, written communication may actually be preferable to oral communication when the objective is higher-order cognitive learning. (p. 90)

Of note, Garrison et al. (2000) make no reference to Hiltz and Turoff's work in this area (or to Hiltz's later extensive work on collaborative online learning).

Garrison et al. (2000) were aware of Hiltz and Turoff's seminal work, however, because *The Network Nation* (1993 ed.) was mentioned once in Garrison et al.'s (2000) publication. This is what Garrison et al. (2000) said: "In fact, when education based on computer conferencing fails, it is usually because there has not been responsible teaching presence and appropriate leadership and direction exercised (Gunawardena, 1991; Hiltz & Turoff, 1993)" (p. 100). What is curious about this quote is the reference date. For unknown reasons, Garrison et al. overlooked Hiltz & Turoff's (1978) original publication, even though Hiltz and Turoff had already reported these, as well as the previously-mentioned findings, *in 1978*. Evidently by the year 2000, the Matilda effect had already begun to set in.

Looking to the Future

From their vantage point in 1978, in which the price of a computer had dropped from millions of dollars to tens or hundreds of thousands of dollars, Hiltz and Turoff predicted "a computer [would be] in every home" (p. 13), with major inroads made in this regard by the 1980s. Building on this, they predicted that the following would be implemented by 1990:

- Computer-based "work at home or at decentralized neighborhood centers" (p. 468);
- The replacement of periodicals, books, libraries, etc. with "an integrated on-line [sic] system of abstract and bibliographic services, text, and data bases [sic]" (p. 468);
- Computer-mediated instruction, "facilitating life-long learning from the home" (p. 468);
- "Electronic funds transfer and shop-at-home services" enabling users to "search for, order, and pay for most goods and services from the home terminal" (p. 468);
- The implementation of satellite communication and "portable telephones" (p. 469);
- Inexpensive, high-quality "home terminals" (p. 469);
- Participatory democracy, with "discussions of public issues . . . allowing interested citizens constant and effective input into the political decision-making process" (p. 469);
- Replacement of printed newspapers with "constantly updated on-line [sic] news" (p. 469); and
- "Emergence and sustenance of family, professional, and leisure-oriented

7

> **networks through computerized conferences" (p. 469).**

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While their timeline may have been slightly ambitious, all of these predictions (with the possible exception of participatory democracy) have indeed come to pass. The language may seem quaint (e.g., "portable telephones," "home terminals"), but the analysis is spot-on.

Computer-Mediated Communication Systems

In 1982, Hiltz published her next book. *Computer-Mediated Communication Systems: Status and Evaluation* **(coauthored with Elaine Kerr) stemmed from a project funded by the National Science Foundation (Kerr & Hiltz, 1982). A synthesis of existing research and knowledge about early computer-mediated communication systems, it was built on the ongoing research into Hiltz and Turoff's EIES, as well as several other conferencing systems, including PLANET, HUB, COMM, CONFER, and more (Kerr & Hiltz, 1982). The book briefly explores system design, but is focused largely on acceptance and usage of CMC systems, as well as on cognitive, behavioral, and affective impacts of CMC upon individuals, groups, and society as a whole. Kerr and Hiltz (1982) summarize their conclusions as follows: "We believe that the challenge [in successful implementation] is not primarily in further perfecting the computer and telecommunication technology, which is already here, but in the 'social engineering' problem of fitting the technological possibilities within particular social contexts" (p. 177). This theme was further explored in Hiltz's next work.**

Online Communities

In 1984, Hiltz published her next full-length work—this time without a coauthor. *Online Communities: A Case Study of the Office of the Future* **summarizes her two-year-long study of communication and cooperation within the scientific research communities that used EIES; this was one of the earliest longitudinal studies of online communities (Hiltz, 2017). As Hiltz (1984) describes, the purposes of the book were twofold: "to convey an 'in depth' understanding of reactions to and effects of this computer conferencing system on the scientific communities which used it, and to assess the implications of those findings for future implementations of similar systems" (p. 2).**

Hiltz (1984) argues that knowledge workers were likely to be among the first to utilize CMC systems, which "will be the central technological innovation characterizing the new type of office work" (p. 3). As with Hiltz and Turoff's earlier predictions, these forecasts largely came to pass. Of note, in 1984, one of the primary concerns with implementation of computer-mediated communication was that of user rejection (Hiltz, 1984). As with her previous work, Hiltz zeroes in on the social and psychological elements of the system, observing that "the strongest predictor of subjective satisfaction with the system is the extent to which it has expanded social networks through facilitating 'meeting' and working with new colleagues who share one's interests" (p. 193). She also notes that "in examining whether the technology produces the intended increases in productivity of 'knowledge workers,' the key variable is not the attributes of the system itself. It is whether the technological potential for increasing social 'connectivity' is indeed realized" (p. 193). She concludes that "with the necessary attention to social engineering, the technology can improve the effectiveness of professional and technical workers in the 'offices' of the future. In doing so, however, it is likely to profoundly change the nature of white-collar work and of the organizations and communities which use it" (p. 197).

Once again, Hiltz's focus on the sociology of computer-mediated communication, rather than its technical aspects, was ground-breaking. It must be emphasized that against the backdrop of the time—with the "nerds" focused on the technological aspects (Segaller,

1998), and the idea that "sociologists do not study computers"—her research in this area was entirely novel.

The Virtual Classroom

Ten years after the publication of *Online Communities*, Hiltz's next full-length work was released. The interim years had been busy. Hiltz had created the world's first fully functional learning management system (or "virtual classroom") and implemented it with a full-scale field trial in 1986–1987 (Hiltz, 1994). *The Virtual Classroom: Learning Without Limits via Computer Networks*, largely based on data gathered during this field trial, was published in 1994.

Hiltz had seen the possibilities for online learning as far back as 1977. She describes the genesis of the idea during a postgraduate seminar on the Sociology of Architecture at Princeton University, in which the final assignment was to design an ideal classroom for the 21st century:

> Suddenly it came to me. A teaching and learning environment did not have to be built of bricks and boards. It could be constructed in software. It could be Virtual! In an era when many teachers and students have their own microcomputers [i.e., the 21st century], it was no longer necessary for them to travel to a classroom . . . the classroom could come to them, over their telephone lines and through their computers. (Hiltz, 1994, pp. 5–6)

From the vantage point of 2021, it's almost astonishing to consider a time in which no one had even conceived of online learning. But Hiltz was so far ahead of the curve in this respect that she actually trademarked the term "virtual classroom" (Hiltz, 1994). As noted above, she created and implemented the first version of a virtual classroom (what we would now refer to as a learning management system). In keeping with the Matilda effect, however, this achievement has all but entirely vanished from view. For example, one summary of the history of online learning states that it emerged in 1989, with the University of Phoenix as the first to offer educational programs online (Kentnor, 2015). This is, of course, factually inaccurate; Hiltz's institution offered several online courses during and after the field trials of 1986–1987 (Hiltz, 1994).

Hiltz's (1994) exploration of online learning is comprehensive, encompassing software tools, online teaching principles (including an in-depth exploration of collaborative learning, a precursor to Garrison et al.'s community of inquiry), research findings, and a look to the future. She describes collaborative learning as being particularly suited to learning online. In her view:

> *Collaborative learning* [emphasis in the original] means that teachers and learners are active participants in the learning process; knowledge is not something that is 'delivered' to students, but rather something that emerges from active dialogue among those who seek to understand and apply concepts and techniques. (p. 23)

Almost thirty years later, this description of online collaborative learning is still highly salient; the structure of the courses within Athabasca University's Master of Education in Open, Digital, and Distance Education is based on this model. Hiltz and her early work with online learning had a significant influence on current practices.

CONCLUSION

This paper has briefly reviewed the contributions of Starr Roxanne Hiltz and her early

9

contributions to the social and psychological understanding of computer conferencing or computer-mediated communication, online communities, and online learning. It has located these contributions in a landscape of the sexist devaluation of women's contributions, particularly within STEM-related fields. It is hoped that this review will assist in bringing the work of this female online learning founder to light and, in doing so, serve to mitigate the Matilda effect on Hiltz and her ground-breaking work.

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