Translating Science, Health and Technology: Reporters as Knowledge Transfer Intermediaries

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Abstract

Reporters link transfer of science/health/technology knowledge between researchers and mass media publics. Levels of reporter literacy in these areas impact their ability to effectively serve as intermediaries in the knowledge transfer process. Reporters' orientation toward acquiring science/health/technology knowledge is important to their choices of education, training, and occupational experience. This study conceptualizes a way to measure such orientation, using descriptive data from an Internet survey of a random sample of reporters to construct an exploratory scale to measure science/health/technology orientation (SHTO). Survey respondents' scores ranged from 4-83 (87 maximum, mean 33.6, SD 15.5). No central tendency was found. Further research and analysis is needed to validate scale construction.

Keywords: science reporters, health reporters, science orientation, knowledge transfer, scale construction

Introduction

Science reporting has been a subset of journalism for more than 100 years, more if one counts such publications as *Scientific American*, which first saw the light of day in 1845. And during that time, science journalism has embraced many different approaches, from a "gee-whiz" stage immediately after the end of World War II, characterized by open-mouthed appreciation for scientific advances, to a "watchdog" stage that continues today, in which journalists were seen as a frontline defense against dangerous science (Rensberger, 2009).

From the early 1900's scientists saw journalists as partners in providing the education they believed the public needed to understand their world and serve as competent citizens (Secko, 2007). And, indeed, public interest in science has remained high, with polls indicating that 40 percent of people actively seek out science news (McInerney, Bird, and Nucci, 2004). Additionally, in 1997, the U.S. National Health Council reported that 75 percent of 2,256 adults surveyed "pay attention to medical and health news and that 58% have changed their behavior based on this information" (Secko, 2007).

Unfortunately, such widespread interest has not necessarily translated into increased science literacy. In 1980, researchers estimated that only 10 percent of U.S. citizens could be classified as scientifically literate (Secko, 2007). In 1985, concern over the status of science literacy in the United States prompted the American Association for the Advancement of Science in 1985 to launch Project 2061, a "long-term initiative to help all Americans become *literate* in *science*, mathematics, and technology" (AAAS, 2009). Project 2061 has comprised a number of research studies, yielding blueprints for accomplishment of this goal. Part of the AAAS initiative has included outlines for more effectively using mass media to aid in effective communication of science to the public.

But questions have arisen as to how well the mass media is fulfilling its role in building public science literacy. For example, the amount of coverage afforded science by newspapers, both in numbers of stories and in extent of column inches, has declined over the past decade (Hays, 1993; Project for Excellence in Journalism, 2008), and media in general have downsized staffs by laying off science reporters and have tried to save money by doing away with science coverage (Brainard, 2008-9; Calamai, 2008; Project for Excellence in Journalism, 2008). Although 96 U.S. newspapers had science sections in 1990, only 47 had them just two years

later (Nordstrom, Wilson, Richards, Coe, Fivek, and Brown, 1999). By 2008, the count of newspaper science sections stood at 35, most now focusing on health and fitness (Project for Excellence in Journalism, 2008). Other factors contributing to this decline include indications that consumers and scientists may not turn to newspapers as the preferred medium for science information exchange (Bruening & Martin, 1992; Bruening, Radhakrislma, & Rollings, 1992; Bruno & Vercellesi, 2002; Oskam, 1992) and that most newspaper reporters possess low levels of science literacy (Haygood, Hagins, Akers, & Keith, 2005). Existing science coverage has often concentrated on controversy and risk, with positive stories receiving little play (Beaudoin & Thorson, 2004; Ten Eyck, 2000). Other researchers note that newsworkers' routines and newsrooms' structures have not been conducive to covering science news (Logan, 2001).

In the face of all this, reporters' abilities to effectively communicate science, health and technology information to the various publics served by the mass media deserve close examination. To obtain such information, reporters either must identify and interview important researchers in these fields or depend upon information subsidies about the research, produced by public information officers (PIOs) from institutions where such researchers work. Among others, Gandy, in his seminal work on the role of information subsidies in news reporters' choice of information sources (1982), and Calamai (2008) have noted that such information subsidies form the basis for 50 to 90 percent of stories appearing in mass media. But questions remain as to reporters' ability to make effective use of such subsidies, as well as to their degree of science literacy and the effect of low literacy levels on the quality of reporting on issues involving science, health and technology (Haygood, Hagins, Akers, & Keith, 2005).

Thus, it is reasonable to conclude that if mass media, even with its current problems, is an important channel by which scientists communicate their work to the public (Peters, 2009) and if reporters are a crucial link in that chain, then the more that reporters know about science, the better they will be able to communicate with scientists and the more effectively they will be able to translate scientists' work for the public (Allan, 2005).

However, because most reporters have received a traditional journalism education and/or on-the-job training, they may lack significant knowledge and skills which would enhance their

abilities to speak with scientists. Such lack of science knowledge and skills may indicate that reporters are not oriented toward science, health and technology and thus do not seek to acquire the expertise needed to effectively transfer information in these areas from sources to the mass media. This study addresses the science, health and technology orientation (SHTO) of reporters and attempts to construct a scale by which such orientation may be measured.

Review of Literature

Theoretical framework for communicating science to the public.

Mass media news forms an important channel for the transfer of knowledge between scientists and the media-consuming public (Peters, 2009). However, to date, fundamental constraints have inhibited such knowledge transfer, among them the fact that scientists and journalists not speak the same language and therefore cannot easily understand each other (Morelle, 2005; Sachsman, 1993). These constraints can be analyzed based on principles of successful knowledge transfer and the theories according to which journalists construct news coverage. The process through which knowledge is transferred from institutional scientists to the public through the mass media may be represented by the following model:

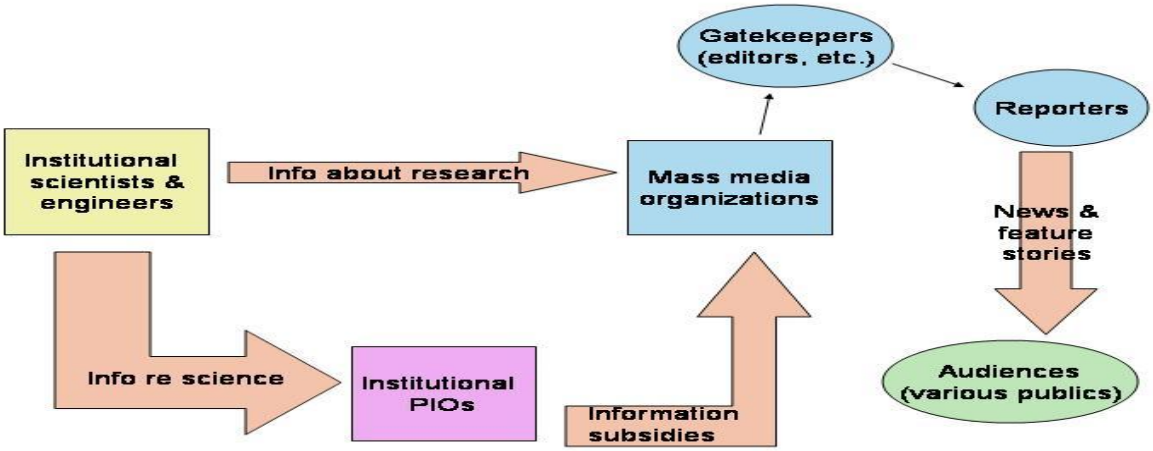

Figure 1: *Conceptual Model of Knowledge Transfer from Institutional Researchers to the Public through Institutional PIOs and Mass Media Journalists*

Successful knowledge transfer depends on a measure of underlying common understanding, upon which apprehension of new concepts, expressed in mutually understood language, can build (Levin, Cross & Abrams, 2002). Such shared foundational knowledge and mutually understood language likewise build trust, which common sense and empirical research have

shown also to be necessary for knowledge transfer to take place (Levin, Cross & Abrams, 2002). Building that shared foundation and common language between scientists and journalists to date has been difficult, in part because, as Sachsman notes

> Scientists and journalists have little in common. They do not even speak the same language. Although both attended universities, they generally took very different courses. They developed different ways of looking at the world, of measuring things, and of reporting what they had learned. Scientists became specialists, judging their work by its importance to the world. Reporters became generalists. … And journalists developed their own peculiar standards for judging their work, standards that included importance, but did not emphasize it. (1993, p.1)

Influencing journalists' decisions about which science stories merit coverage are the theories of agenda-setting and framing and the standards for information sourcing which these theories dictate.

It is generally accepted that opinion leaders help define those issues about which the public should think (Dearing & Rogers, 1996; McCombs & Shaw, 1976; McQuail, 1994; Rogers & Dearing, 2000) and that the media helps communicate such agenda salience, through a process explained theoretically as ***agenda-setting***. The theoretical concept of ***framing***, on the other hand, helps guide the public as to **how** it should think about a particular issue. Framing provides context for opinion formation and discussion (DeFleur & Ball-Rokeach, 1989; McQuail, 1994; Reber & Berger, 2005). Frames developed by reporters contribute to constructing schema to help the public place issues into understood and shared contexts (McQuail, 1994; Reber & Berger, 2005). Such media frames facilitate individual and societal construction of meaning out of larger events (DeFleur & Ball-Rokeach, 1989; Reber & Berger, 2005) and may best exert the effect intended by their authors when they focus on audience self-interest, for example, how to avoid a perceived threat (Rodriquez, Farnall, Geske, & Peterson, 1998). Scheufele (1999) wrote that journalistic frame-building is influenced both by the ideology, attitudes, and professional norms of individual reporters and by their organizational routines. Reporters themselves are susceptible to agenda setting and framing of issues by the coverage of such stories in media they regard as particularly

prestigious and credible, a process termed the "news wave" (Breed, 1955; Dunwoody, 1979; Havick, 1997; Ten Eyck, 2000).

Agenda-setting and the news waves of arterial effects (Breed, 1955) it generates may mean reporters are forced to adopt others' frames via consulting the same or similar sources. A frame establishes an associative pathway between a target issue and a specific set of concepts. By activating or suggesting some ideas at the expense of others, the news can encourage particular trains of thought about phenomena and lead audience members to arrive at more or less predictable conclusions. Framing, or rendering certain thoughts applicable, is most likely to occur when the suggested ideas are relatively accessible prior to exposure (Tewksbury, Jones, Peske, Raymond, & Vig, 2000), seemingly a reaffirmation of the idea that knowledge transfer succeeds best where it can build upon understanding an audience already possesses.

A story frame is built largely around a reporter's concept of newsworthiness, comprising such factors as conflict and proximity, as well as that reporter's sense of the story's contextual salience. Conflict is the heart of reporters' traditional conceptions of newsworthiness, and risk controversies have become one of the staples of modern public life, a constant within a world that sees policy-making as the result of political contest and struggle: "Risks do not emerge as issues for the media, the public or even for experts according to their intrinsic importance, but in interaction with social processes including bureaucratic procedures and promotional strategies" (Miller, 1999, p. 1242). Miller wrote that one public perception of risk communications from government officials and other experts is that scientists and politicians may provide deliberate misinformation in order to manipulate public opinion according to their own agenda.

When the media cover issues of interest to the public, they may or may not overrepresent sources on one side of a conflict. In addition, reporters prize exclusives, excitement, or controversy, and although they may try to uphold an ideal of objectivity, often reporters lack the specialist knowledge to realize what it means to give equal time to each side in a complex issue (Wells, Marshall, Crawley, & Dickersin, 2001).

Stories about risk capture the reporter's instincts for conflict as central to the stories they write. Thus, complex topics such as the benefits and threats offered by genetically modified

crops become couched as conflicts between technology and the beauty of nature, as illustrated by the story of the effects of pollen from genetically modified corn on Monarch butterflies (Shelton & Sears, 2001). Militaristic metaphors predominate in describing agricultural controversies, e.g., treatment of invasive species and foot and mouth disease (Larson, Nerlich, and Wallis, 2005). And Alaszewski and Horlick-Jones (2005) wrote, "While experts can measure risk and (attempt to) communicate their measurements to the public, this information is filtered through various media and interpreted by social groups and individuals" (p. 730).

The slant of media risk coverage may have its origins in differences between the ways in which scientists and members of the public perceive risk: "Risk communication — the science of understanding scientific and technological risk and how it is communicated within a sociopolitical structure — is a relatively new scientific endeavor" (Blaine &Powell, 2001, p. 180). People in North America receive most of their scientific information from media, including newspapers, television, radio, and the Internet; thus, it becomes increasingly critical for scientists to learn how better to communicate risk in terms that both the press and the public can understand, as well as how to dialogue more effectively with farmers and others (Clarke, 2003).

Although the idea of informed consent for medical or scientific procedures is presented to the public as the ideal, most people are unfamiliar with the idea of scientific uncertainty and the need to balance risks and benefits: "It can be difficult for professionals to judge the quality of evidence, and it may be unrealistic to expect a detailed discussion and understanding of these issues in the lay press, where space is limited and unequivocal messages preferred" (Wells, Marshall, Crawley, & Dickersin, 2001, p. 1035).

For example, 90% of newspaper stories addressing the development of resistance to antibiotics do not outline simple precautions the public could take to prevent the problem:

> In only twenty-four words, journalists could cover two key measures with a sentence such as "Individuals can reduce the development of antibiotic resistance by only taking antibiotics for bacterial illnesses, and by taking the full course of antibiotic prescriptions." ... Experts could help journalists by offering information in clear, organized and concise messages that are geared toward the public as an audience, and with

> recognition of the deadlines and other contingencies faced by members of the print media. Experts could be particularly helpful by emphasizing key take-home messages, so that journalists could in turn include those messages in their stories. (DeSilva, Muskavitch, & Roche, 2004, p. 40).

Selecting and seeking out sources for the information from which to construct stories is a job function common to all reporters. It is axiomatic that reporters report the news; they do not make it. In their role as "eyewitnesses to history," certain types of reporters, such as war correspondents and sports reporters, may bring to their readers first-person accounts of what they themselves see, hear, or otherwise experience. However, many reporters craft accounts of events that have taken place outside of their immediate experience; they must seek out others who can tell them about what has happened and who can help them interpret what events mean to the public (Heinrichs & Peters, 2004; Simonson, 1999). Such others are called sources, and reporters try to choose the best sources for a given story based on the source's institutional position, knowledge, accessibility, or cooperativeness , or some combination of these characteristics

By definition, scientists would seem to constitute the best sources about science. In covering science stories directly or stories that depend on understanding scientific principles, mass media reporters' abilities to identify and successfully use appropriate news sources are paramount to effective, reliable news coverage. Such complex, science-intensive stories lie outside the everyday experience of most reporters and require knowledge beyond their usual education. The identification of knowledgeable sources and the scrupulous attribution of the information they provide is crucial to the accurate telling of these stories (Albaek, Christiansen, & Togeby, 2003). Not only must reporters involved with coverage of such events not make up information or fabricate sources, they must identify and accurately report the "right" sources to explain such matters to their readers (Lee, 2004).

Researchers have noted that coverage by science specialty-beat reporters differs from that by general assignment reporters in quantity, type, and tone (Craft & Wanta, 2004; Long, 1995; Shoemaker, Eichholz, Kim & Wrigley, 2001). Other studies concentrating on relationships between specialty-beat reporters and their sources found that such reporters often use the same sources continually, building strong bonds with them (Chermak, 1995; Dunwoody, 1979;

Gandy, 1982; Ten Eyck, 2000) and often focusing almost exclusively on institutional representatives who may be depended upon to furnish information (Ericson, Baranek, & Chan, 1993; Sumpter & Braddock, 2002). Other researchers have called for media to concentrate to an even greater extent on scientists as sources for complex stories (Cassidy, 2004; Ramsey, 1999), although they note that a reporter's ability to deal effectively with such expert sources may depend heavily upon that reporter's science training (Grantham & Irani, 2004; Vestal & Briers, 1999; Wingenbach, Rutherford, & Dunsford, 2003).

Other studies have highlighted the links between media coverage and the public's acceptance of technological innovations in agriculture like biotechnology (Besley & Shanahan, 2005). But to report about such innovations, reporters must have an adequate knowledge base from which to interact with experts. Science specialty-beat reporters strive to be objective, but that they do best when they understand the topics about which they are writing; thus, respondents in their survey "formed their perceptions about biotechnology through knowledge and experience (science classes and labs), which is conducive to understanding and reporting accurately the science of biotechnology" (Wingenbach, Rutherford, & Dunsford, 2003, p. 1).

Other researchers agree that coverage is highly dependent on the level of science literacy of those in the media (Haygood, Hagins, Akers, & Keith, 2005), with specialty reporters interpreting their subject areas more narrowly and being more likely to consult scientists (Anderson, Peterson & Davis, 2005; Bauer & Bucchi, 2007; Dunwoody, 1978). Reporters' and editors' agricultural literacy levels play an important part in their abilities to explain the science in their stories to a public when only 20% of its members may meet basic definitions of scientific literacy (Haygood, Hagins, Akers, & Keith, 2005).

Clearly, reporters are an important link in the chain of knowledge transfer between institutional scientists and engineers and the public, through mass media channels. However, reporters themselves must become educated in the language and principles of science in order successfully to fulfill that role. Criticisms of media science coverage illustrate the need for such education.

Criticisms of media coverage of science.

Scientists themselves understand the importance of communicating what they do to the public, "frequently working the media themselves, in order to make arguments that cannot be aired via everyday academic communication routes such as journal stories or to reach audiences outside their own discipline" (Cassidy, 2004, p.3). And reporters see scientists as particularly credible sources (Heinrichs & Peters, 2004) and themselves as agents of mediation of information to the public from such scientists and experts.

However, critics of journalists' science coverage charge that the media either are incompetent to transmit information about science issues as complex as global warming or they introduce confusion about it (Meyer, 2006; Mormont & Dasnoy, 1995). Such critics recommend a more active role for expert sources in interpreting science for the public.

And researchers caution that reporters frequently may decontextualize source comments by eliminating descriptions of surrounding circumstances and of the sources themselves (Heinrichs and Peters, 2004). Indeed, other researchers, have cited a journalistic practice of "rel[ying] heavily on unnamed sources (proponents, experts, environmentalists, etc.) and poorly identified advocacy groups" (Beall & Hayes, 1992, p. 6).

Some critics of media science coverage believe it would be most productive to try to teach news sources how better to interact with the media, because in their opinion no amount of training can turn reporters into scientists (Sachsman, 1993). A number of scientists in fact see themselves as working well with the media (Valenti, 1999); these individuals do not fear being misquoted and "generally found media people competent, professional and pleasant to work with," and said "they use the news media because they can reach many people fast, effectively and economically" (Sperbeck,1997, p.24). Thus, the literature reflects the concern that mass media science coverage needs improvement and that ways must be found to improve communication between scientists and journalists, although just how this is to be done is a matter for debate.

In order to interpret for the public information received from expert sources, reporters also may need to provide more analysis about the relevance and implications of scientific research (Long, 1995; Steinke, 1995). Such additional information and expanded explication no doubt

depend on a reporter's science training. The idea of special training for reporters is supported (a) by research indicating that coursework in the sciences "provides the background needed to decode and define scientific terminology, even outside of one's area of specialization," increasing scientific literacy (Grantham & Irani, 2004, p. 48) and (b) findings that although metropolitan news journalists responding to their survey expressed "greatest faith in 'university scientists' as sources" (Vestal & Briers, 1999, p. 22), that faith was coupled with relatively low knowledge levels about topics such as biotechnology. Reporters educated about science, health and technology through formal coursework or media workshops were found to be more objective in their coverage of controversial stories (Sitton, Cartmell, & Keys, 2004) and might be expected to choose and to use sources differently. Thus, research would seem to support the idea that reporters need more education in fields related to science, health and technology in order to provide better coverage and more effective knowledge transfer regarding issues related to such fields.

Study Objectives

This pilot study explores aspects of the premise that since reporters serve as intermediaries in the process of knowledge transfer between institutional researchers and mass media audiences, improvement of reporters' knowledge transfer abilities could result in improvement of mass media science coverage. Crucial to such increased knowledge transfer competency is improvement in reporters' grasp of basic principles that underlie science, health and technology research and development. Reporters' orientation to science, health and technology – their inclination toward acquiring expertise about such subject -- may be an important determinant of acquisition of such knowledge and could even serve as a proxy measurement for knowledge levels.

Although many researchers have studied aspects of science communication and attributes of its practitioners, some even accessing the same population as this study (Triese & Weigold, 2002; Cooper & Yukimura, 2002), none have attempted to evaluate the role of a composite science, health and technology orientation score in reporters' attitude formation and practice. Thus, this study focuses on investigation of this orientation and construction of a scale to measure this composite attribute.

Research questions.

The study sought to answer the following general research questions:

RQ1: What are the salient attributes, including education and training and experience in science and science journalism, of reporters engaged in the communication of science/health/technology information to the public?

RQ2: Is there a detectable orientation toward science/health/technology among reporters engaged in the communication of such information to the public?

Methods

Study design, population of interest, and sample.

The data forming the basis of this study has been extracted from a much larger mixed-methods, multi-level inquiry. This larger study has yielded data to provide a comprehensive picture of the characteristics, attributes and attitudes of sample members, which can be generalized to the subpopulations involved and which may be hypothesized to describe a larger universe of science, health and technology writers/reporters and the public information officers who seek to influence them.

As the part of this larger inquiry, quantitative data was collected through an online survey of samples from two subpopulations selected from members of the National Association of Science Writers (NASW), who constitute this study's population of interest. NASW is one of the nation's oldest and largest professional organizations dedicated to the advancement of science, health and technology journalism. Membership in this group is restricted to journalists and PIOs demonstrating active involvement with communication of science, health and technology information through providing samples of their work and securing recommendations from two current NASW members. NASW has approximately 2,900 members, divided into two subpopulations of reporters/writers (approximately 1,500 members) and PIOs (approximately 1,400 members) according to employment information supplied to the organization.

Two samples, one each of reporters/writers (306) and of PIOs (249) (Barlett, Kotrlik & Higgins, 2001), were randomly selected from a list of names and email addresses of each member (after elimination of those members who chose not to provide email addresses) for

administration of occupation-specific online surveys. In addition, surveys were mailed to all members (approximately 100 for each group) without listed email address. This article focuses exclusively on analysis of responses from NASW reporter/writer members.

Data collection, response rates, and data analysis.

The original online instrument was administered to each group sample using Dillman's modified five-iteration survey method (Dillman, 2000), designed to increase response levels. Survey coding provided for data to be loaded automatically into a Microsoft Access database as each respondent hit the "submit" button on the survey. Once a respondent's data had been loaded into the database, all identifiers were removed from his/her entry.

In addition, a mail survey was sent to all NASW members without listed email addresses (approximately 100 individuals). As in the Internet survey, five iterations of letters were sent out. Data from returned questionnaires was manually entered into the same database as those acquired from Internet respondents, and, similarly, all identifiers were removed from these responses. Upon completion of survey administration, data was transferred to SPSS software for statistical analysis.

Survey recipients were given the choice to opt out of the study, and 50 reporters did so. In addition, 44 reporter email addresses were not operational. Thus, the total number of potential reporter respondents was 213 (Field, 2009; Ott & Longnecker, 2001). Of these potential participants, 102 valid completed questionnaires were received, for an effective response rate of 47.9 percent.

Findings

Completed questionnaires yielded information about reporter/writer members of NASW, including demographic characteristics; attitudes about important issues in the field of science, health and technology journalism; work products produced; workplace characteristics; and attitudes toward NASW itself. However, this article focuses on those attributes pointing toward the existence of a career path for reporters, which taken together make up their orientation toward science/health/technology, an orientation contributing to their attitudes, work products, workplace choices, and dispositions toward NASW as previously mentioned.

Therefore, descriptive statistics are presented below for the following reporter attributes: level of educational attainment, college major, additional training, years in the field of science/health/technology education, years in NASW, and specialization in science, health or technology public information. Subsequently, a conceptual model of the ways in which these attributes might be hypothesized as forming a composite measure of an individual reporter's science, health and technology orientation (SHTO) is presented, followed by presentation of frequencies of the SHTO constructed variable.

Descriptive results.

Reporters who responded to the study were an educated group, with 92 percent of them having college or advanced degrees. The majority of the respondents had earned masters degrees (48 percent), with 22 percent holding bachelors degrees, 19 percent having doctorates, and 3 percent having earned professional degrees. The majority of respondents (66 percent) majored in fields related to science, health or technology (37 percent), in journalism (19 percent), or in science journalism (10 percent).

In addition to their formal education, almost half (48 percent) of respondents had received special training or occupational experience that helped them fulfill their job duties. Types of additional training completed primarily included journalism, science journalism or science coursework separate from their college majors. Occupational experience that was seen as helpful to a science/health/technology journalism career included work as a PIO, as a scientist or healthcare professional, and as a public school or university instructor in either journalism, science, or health.

Respondents were experienced reporters, with 92 percent of them having six or more years in the field, the majority (72 percent) with more than 10 years reporting experience and one-quarter of them in the field more than 25 years. The majority of respondents (63 percent) clustered between six and 15 years of membership in NASW, although 19 percent had maintained NASW ties for more than 20 years.

The majority of respondents (82 percent) reported having specialties in science (58 percent), health (22 percent), technology (2 percent) or some other related field (12 percent), including

writing about oncology, biotechnology, earth science, sustainability, environmental health, and celebrity health features.

Conceptual model.

The idea that a scaled score could be constructed to summarize reporters' orientation to science, health and technology is an exploratory one. Figure 3 represents a conceptual model of the possible composition of one such constructed scale.

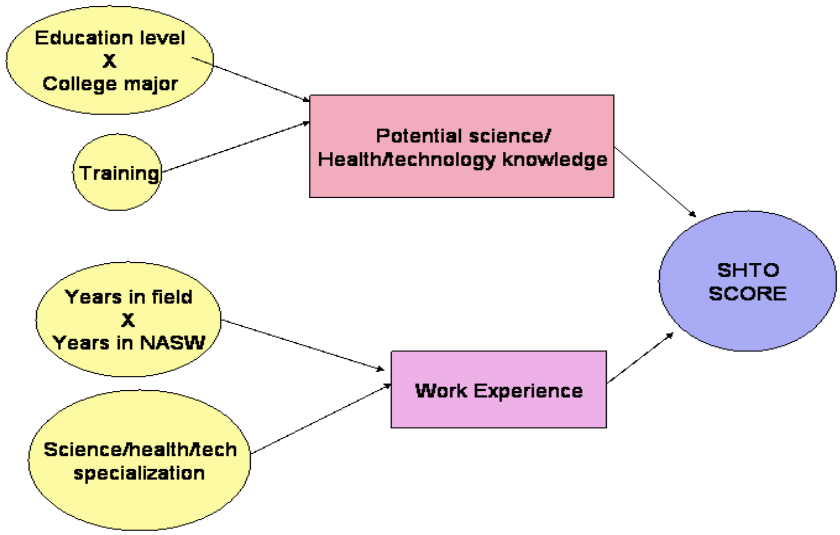

Figure2: Components in Construction of Composite SHTO Score for Reporters

Reporter SHTO.

Ordinal values were assigned to educational level, college major, additional training and job specialization; interval values were collected for tenure in the field and in NASW. The following mathematical formula was used to calculate a composite SHTO score for each respondent:

SHTO SCORE = [Educational level * college major] + additional training + [years in field * years in NASW] + job specialization

Multiplication of educational level by college major represents the assignment of greater weight to reporters' educational preparation (Allan, 2005; Grantham & Irani, 2004; Vestal & Briers, 1999; Wingenbach, Rutherford, & Dunsford, 2003). Similarly, multiplication of experience levels represents privileging of job and professional organization experience in the

calculation of orientation (Cooper & Yukimura, 2002; McInerney, Brid, & Nucci, 2004; Schultz, 2002; Triese & Weigold, 2002). The pattern of weighting chosen reflects not only the findings of other researchers, but also belief that choice of college major and pursuit of advanced degrees in fields related to one's occupation serves as evidence of high science, health and technology orientation, as do decisions to remain in the field of science, health and technology public information and as a member of the largest and oldest organization for science writers.

Respondent reporters' calculated SHTO scores ranged from 4 to 83 out of a possible maximum score of 87, with a mean of 33.6 and a standard deviation of 15.5. Figure 3 shows the distribution of values for this constructed scale.

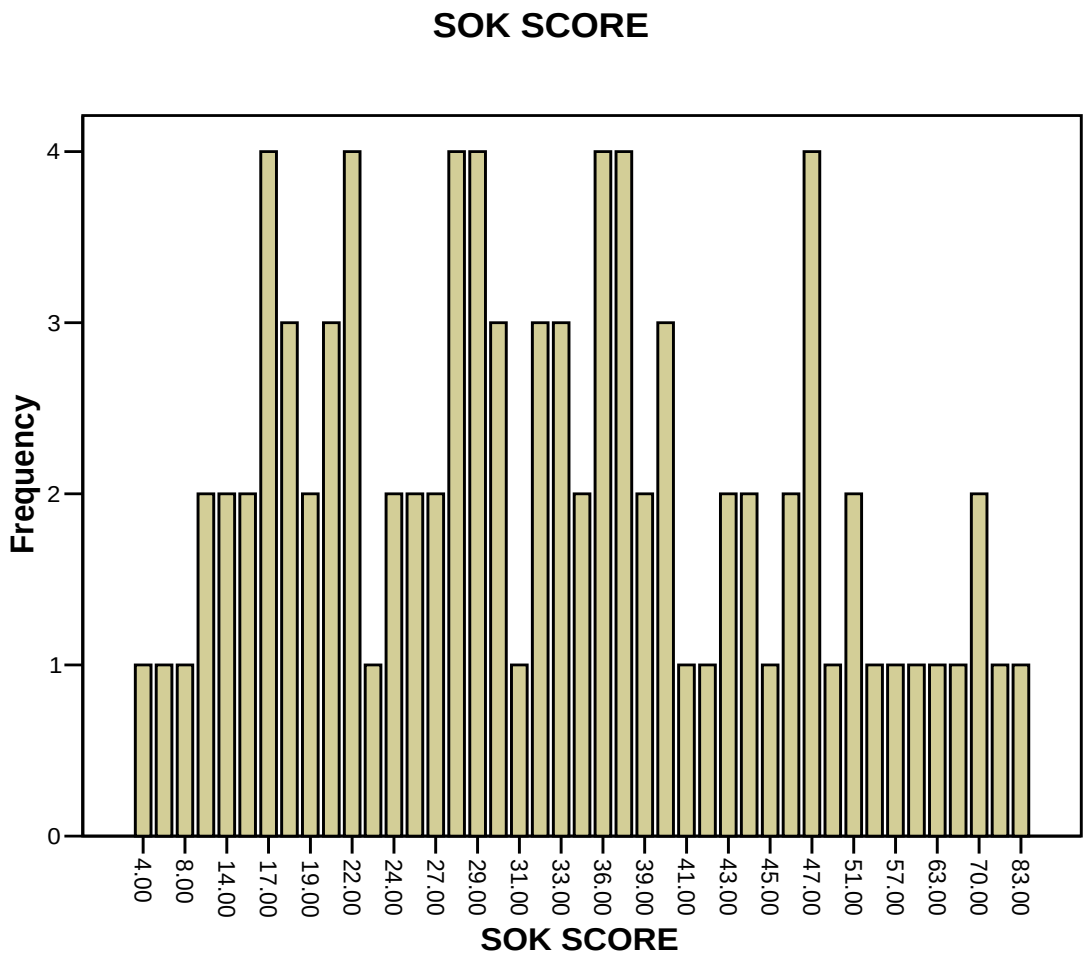

Figure 3 . Distribution of Reporters' Science/Health/Technology Orientation Scores

Figure 3 shows no clustering or scores, nor do the scores shown exhibit any central tendency or normal distribution.

Discussion

Review of the literature suggests that in order to present, explain and interpret experts' information on science, health and technology topics for public audiences, reporters may need to provide more analysis about the relevance and implication of such research (Long, 1995; Steinke, 1995). Such additional information and expanded explication no doubt depend on a reporter's fund of science, health and technology knowledge and understanding. Thus, reporters should ideally be expected to seek out specialized education and training, leading to increased knowledge in these fields. Motivation to seek out enhanced science-related educational experiences may depend on a reporter's basic orientation toward these knowledge areas.

This article presents an exploratory attempt to construct a scaled score to measure self-identified science, health and technology reporters' science, health and technology orientation (SHTO score), using descriptive data collected as part of a larger inquiry into the characteristics, work products and practices of such reporters. It provides a preliminary answer to RQ1 by presenting descriptive summaries of data collected about reporters' education, training, and experience in science, health and technology and in communication of such information to the public.

Analysis of this descriptive data revealed that the majority of reporter respondents had earned masters degrees, had majored in fields related to science, health or technology, had completed specialized job training in addition to their formal education, had six or more years in science/health/technology reporting/writing, clustered between six and 15 years of membership in NASW, and specialized in science journalism. The fact that 37 percent of study respondents had chosen to major in fields related to science, health or technology and 10 percent majored in science journalism, while only 19 percent majored in "straight journalism," argues for the presence of a high degree of motivation toward seeking science/health/technology literacy and toward a elevated level of orientation to science-related fields among these reporters.

Application of the proposed SHTO formula to calculate a unique score for each individual PIO yielded values ranging from 4 to 83 out of a possible maximum score of 87, with a mean of 33.6 and a standard deviation of 15.5, but no central tendency or normal distribution of scores. There also were multiple score clusters, with four respondents each grouped at scores of 17, 22, 29, 30, and 47 respectively.

Analysis of SHTO scores indicates that there is a detectable orientation toward science, health and technology among reporters (RQ2), but does not answer questions about the validity of the formula used to construct the scale nor about the appropriateness of the items chosen for inclusion of this scale. Lack of a normal distribution of the scores does not argue well for use of inferential statistics in further analysis of SHTO score, even though the data was collected using a random sample and through a survey which had been validated by a panel of experts and pilot testing. At this exploratory stage, the most that can be said is that more than half of the respondents indicate some evidence of elevated SHTO scoring.

The author intends to conduct further exploratory inquiries consisting of calculation of intercorrelations and other statistical relationships among SHTO score and other data collected in this study, including reporter demographics; reporter attitudes toward such issues as sourcing, media gatekeeping, determinants of newsworthiness, and disposition of media consumers toward science/health/technology news; reporter work products, including extent of coverage on "hot" science/health/technology topics, numbers of news stories produced for a given period, and sourcing and practices; and reporter workplace characteristics such as ownership and job assignments.

The author also intends to identify and perform more stringent tests of validation of the SHTO scale construction and to report the results of such tests. Such results will help to guide possible modification of the items included in SHTO score calculation and the weighting of items in the formula, which itself may need to be revised. Further research involving samples from other reporter populations may be a necessary step in this validation process.

The author realizes that descriptive data may be not be extrapolated to samples and populations other than the one reported upon here. Further, extrapolation of other findings using inferential statistics from the larger study may be limited by the fact that the population

from which the sample was drawn consists of NASW members. A self-selected group of science, health, and technology reporters apply for membership in this organization, and their applications are subject to approval by the organization itself. Thus, a case could be made that members of NASW are not representative of the larger population of all science/health/technology reporters.

Despite the limitations of the study and the problems raised by the extant SHTO formulation and calculations, the author believes that establishment of a valid and reliable measure of reporters' orientations to science, health and technology is an important endeavor. Such a score and its quantification of reporter education, training and experience could help to guide the education of future science/health/technology journalists. Improvement in SHTO scores could be tied to improvements in science literacy called for by AAAS and others, through helping reporters to become more adept at the effective transfer of knowledge from those who practice science, health and technology research to the publics who need and want to understand the results of those endeavors.

Science, health and technology reporters, who are members of the profession of journalism, constitute an important link in the chain of knowledge transfer and serve as a crucial resource for mass media's diverse publics. It is vitally important for journalism scholars to assist in the definition of how reporters may better function in that role and in design and implementation of programs of study aimed at facilitating such improved functioning.

Conclusion

Science, health and technology journalism have a long history in the United States. Mass media audiences continue to evidence interest in stories produced by such journalists, although media outlets have in recent years reduced the amount of coverage and staffing afforded these issues. And such journalism has not, according to numerous researchers, led to the type of informed publics that might have been predicted by its earlier practitioners.

In fact, concern over the status of science literacy in the United States has prompted AAAS and others to call for more effective use of the mass media to aid in communication of science information to the public. To some extent, mass media has heeded that call, with reporters serving as translators between scientists and other experts and their various publics. And

public information officers at institutions where science, health and technology researchers work usually are charged as acting as intermediaries between the mass media and such researchers, with PIOs working to help get out the word about important developments in these fields, in the form of providing editors with information subsidies such as news releases, authoring information for the institution's Website, and direct contact with reporters and editors to offer them the institution's researchers as sources for stories on important issues.

This study indicates that many reporters already possess some specialized education and training that helps them in transferring science, health and technology information for lay audiences. But the range of exploratory SHTO scores (83/87 being the highest score and 4/87 being the lowest) argues for more attention to reporters' science/health/technology orientation as predictive of their motivation to acquire more content knowledge and training.

The author looks forward to expanding the reliability and validity of the SHTO scale proposed here, as well as to further analysis of the data collected in this mixed-methods study and to extending the inquiry to samples from other reporter populations.

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