

THE WIDENING INFORMATION GAP BETWEEN HIGH AND LOW EDUCATION
GROUPS: KNOWLEDGE ACQUISITION FROM ONLINE VS. PRINT NEWS

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ABSTRACT

JungAe Yang

The Widening Information Gap between High and Low Education Groups:

Knowledge Acquisition from Online vs. Print News

The primary purpose of this study is to empirically investigate the potentially widening gap in information acquisition across different educational groups, related to traditional print versus online news formats. Newspaper readership is declining and simultaneously the number of online news users is growing. In democratic societies the ability of new media formats to deliver cognitively accessible information to all citizens is indeed a pressing issue. This dissertation adopted the strengths of both survey and experimental traditions of knowledge gap research. Specifically, this study follows in the survey research tradition by emphasizing social structural aspects of the knowledge gap phenomenon. At the same time, this research used controlled experimental procedures and an assortment of memory measures to rigorously investigate the formation of knowledge gaps. The experimental procedure also allowed for focus on a much neglected dimension of knowledge gain, namely news exposure preferences (public affairs vs. entertainment) of citizens. To this effect, news exposure was examined using a behavioral measure, which is more rigorous than the heavily relied on self-report measure.

The findings show strong support of the existence of knowledge gaps. First, participants in the higher education group (some postgraduate education) outperformed the lower education group (no more than a high school education) in terms of information gain, particularly for public affairs information, despite the similar news exposure pattern across the two education groups. The strong education effect on public affairs knowledge acquisition is therefore robust beyond the influence of news exposure levels. Second, newspaper readers exposed themselves to

more public affairs news than online news users and therefore acquired more public affairs information than online news users. Third—and most important and alarming—comprehending public affairs news stories varied most prominently between the high and the low education groups in the online news condition.

As such, the findings of this dissertation produced evidence that supports the main thesis of a widening information gap between high and low education groups, driven more so by new media than traditional print media use. In conclusion, emerging media are likely to exacerbate the existing information gaps among citizens with different socio-structural backgrounds.

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CHAPTER 1

Introduction

Background to the Study

In democratic societies, it is important for the public to be sufficiently informed about important public affairs, in order to perform their duty and exercise their rights as citizens (Delli Carpini & Keeter, 1996). Although people learn basic information about politics from formal education in schools, the primary information sources for the majority of people on matters related to politics and public affairs are the media (Delli Carpini & Keeter, 1996; Eveland, Hayes, Shah, & Kwak, 2005). Thus, the effects of media on the public's acquisition of political and public affairs information have initiated a major research tradition in the field of communication (Price & Czilli, 1996). One strain of research in this tradition has been concerned with the idea that different media have varying influences on citizens' ability to absorb public affairs information, with particular emphasis on newspapers and television (Chaffee & Frank, 1996; Chaffee & Schleuder, 1986; DeFleur, Davenport, Cronin, & DeFleur, 1992; Furnham & Gunter, 1989; Furnham, Gunter, & Green, 1990; Garramone & Atkin, 1986; Neuman, Just, & Crigler, 1992; Robinson & Levy, 1986, 1996). Another line of research has focused on differential knowledge gain across different population groups of society, or the so-called knowledge gap phenomenon (see Gaziano, 1983, 1997; Viswanath & Finnegan, 1996, for reviews). Both research areas serve as meaningful signposts for the current study. In fact, this dissertation is primarily concerned about the gap in knowledge acquisition between people from different social backgrounds, across two distinct media (newspapers and online news sites).

As recent survey data have shown (Fallows, 2004; Pew Research Center, 2004, 2006), the number of users who access the World Wide Web for news consumption is continuously

growing because it allows convenient access to frequently updated news in large quantity, typically without charge (Althaus & Tewksbury, 2000; Knobloch-Westerwick, Sharma, Hansen, & Alter, 2005). As a result, research attention to the Web as a news medium is expanding as well (Ozcelik & Yildirim, 2005). Following in the research tradition of comparing learning outcomes across news media, quite a few studies have examined media user learning from traditional mass media (typically newspapers, and occasionally, news magazines or TV news) versus new media (e.g., online newspapers, portal sites, educational sites, or informative sites) (Eveland & Dunwoody, 2001b; Eveland & Dunwoody, 2002; Eveland, Seo, & Marton, 2002; D'haenens, Jankowski, & Heuvelman, 2004; Fico, Heeter, Soffin, & Stanley, 1987; Heeter, Brown, Soffin, Stanley, & Salwen, 1989; Tewksbury & Althaus, 2000). Overall, this body of research shows that print media have a slight edge (at least in the amount of acquired information) over new media (see Eveland, 2003; Eveland & Dunwoody, 2002; Eveland, et al., 2002 for reviews). It is noteworthy, however, that print media's superiority in facilitating learning does not mean null effects for online media. Even though certain characteristics of new media (e.g., relatively high user control) might have some negative influences on audience learning, online media in general can enhance user learning compared to nonuse of media. Indeed, a couple of empirical studies (e.g., Norris, 2002; Norris & Sanders, 2003) have found that Web news consumption is significantly associated with learning outcomes after controlling for the amount of traditional news media use (newspapers and television news).

If learning from the Web is an important issue at the individual level, information inequality within or across societies is one of the major social level issues we are confronting with new media. This problem is particularly important as significant unequal acquisition of public affairs knowledge among different segments of the population is well documented in knowledge gap research. To make matters worse, it seems unlikely that the problem of unequal information gain can be overcome by merely increasing the number of new media users. With

the advent of new information and communication technologies (ICTs), represented by the Internet, access to information became central to the “new media” and “information society” debates (van Dijk, 2000). Some early theorists (e.g., Abramson, Arterton, & Orren, 1988; Castells, 2001; Gates, 1995) argued that new ICTs would narrow information inequalities through their unique characteristics, including being decentralized (i.e., non-hierarchical), widely available, and easily accessible, coupled with the decreasing cost and increasing user-friendliness. These optimistic predictions, however, have been challenged by a number of researchers (e.g., Golding, 1998; Norris, 2001; Selwyn, 2004; Tapscott, 1996; van Dijk, 2000; van Dijk & Hacker, 2003).

Technological optimists have advocated for the so-called “natural diffusion” thesis (Selwyn, 2004) which proposes that unequal use of a new technology naturally occurs at the beginning of the adoption process, and as the innovation is being diffused to the broader population, such disparities disappear. The original theory on the diffusion of innovations (Rogers, 1995), however, predicts uneven diffusion of new technologies; people with higher socioeconomic status (SES) are more likely to be early adopters. Even when the technology adoption is saturated, disparities persist rather than disappear. Access to computers and related communication technologies requires not only widely distributed infrastructure and fully functional accessories but also frequent updating after the initial purchase, unlike older media devices such as television or radio sets (Kling, 1999; van Dijk & Hacker, 2003; Willis & Tranter, 2006). Even supposing that the gap in hardware ownership will decrease considerably in the near future, it seems doubtful that slow adopters will ever catch up with early adopters (van Dijk & Hacker, 2003; Willis & Tranter, 2006).

As such, physical access to technologies seems closely related to existing socioeconomic inequalities that are not likely to be solved with the saturation of new media. The original

knowledge gap theory regarded social structural factors as the underlying causes of differential knowledge gains. Likewise, recent studies (Bonfadelli, 2002; van Dijk, 2000; van Dijk & Hacker, 2003; Willis & Tranter, 2006) posited the issue of new information inequality as the extension of existing socio-structural disparity. What makes the current information gap debate distinct from the old knowledge gap research is that the former primarily focuses on differential practical use of new media (van Dijk & Hacker, 2003) while the latter is concerned with differentially acquired knowledge. It seems quite optimistic to assume that possession of a technology will result in similar use among owners and an evenly informed public (Bonfadelli, 2002; Jung, Qiu, & Kim, 2001).

A number of researchers (Bonfadelli, 2002; Golding, 1998; Hargittai & Hinnant, 2008; Jerit, Barabas, & Bolsen, 2006; Kenski & Stroud, 2006; Norris, 2001; Prior, 2005; Selwyn, 2004; Sunstein, 2001; Tapscott, 1996; van Dijk, 2000; van Dijk & Hacker, 2003) joined the position that new communication technologies would exacerbate, rather than close, the existing information gap, due to unique characteristics. First, newer media are typically multifunctional, used for purposes ranging from simple audio/video playback, to word-processing, electronic game playing, online shopping, teleconferencing, and data-analysis. Second, the sheer amount of information available in online news media is virtually unlimited—incomparable to that offered through traditional media. Third, the diversity of news content offered online seems endless—from strongly opinionated news blogging, to citizen journalism through YouTube posts, to the online versions of traditional media such as CNN.com. Such features of new media are likely to encourage highly selective use among new media consumers matching their specific needs. For instance, some people might use new media mainly for informational purposes such as database searching or online news consumption while others might use the same media for entertainment purposes such as playing games or chatting.

With the rapid development of new media technologies, comes the growing necessity for new skills such as assessing source reliability, searching information purposefully, and interpreting information meaningfully, let alone adequate technological skills (Bonfadelli, 2002; van Dijk & Hacker, 2003; Hargittai & Hinnant, 2008). It seems likely that relevant skills for using new (news) media in meaningful ways are also unevenly distributed across different segments of the population and accordingly might create additional differences among user groups, perhaps reinforcing information disparities. In fact, new media users are expected to perform information management functions previously taken care of by media content producers, including journalists and editors in traditional media (Bonfadelli, 2002). Specifically, traditional news media such as newspapers and television news provide a limited number of news stories through selection and exclusion processes (i.e., gatekeeping) based on a set of professional criteria for what constitute newsworthiness. Furthermore, news stories are featured in traditional media with different levels of prominence through a variety of story importance cues (e.g., article length, headline size) (Althaus & Tewksbury, 2002; Fico, et al., 1987; Graber, 1984; Heeter, et al., 1989; Thorson, 2008). Thus, consumers of traditional news media are not typically required to spend much effort in deciding which news stories are worth attending to.

Even in comparing a specific online news format that might be directly comparable to traditional news sources, the information gap still seems to be more prominent with newer media, due to its unique features. With older media such as newspapers and television (particularly TV news), exposure to media guarantees at least some access to socially important information, or public affairs information (Hollander, 2008). Substantially wider variance in content as well as the greater informational volume of online news leads to an increased burden of content selection on media users. Indeed, a number of researchers (Curtain, Dougall, & Mersey, 2007; Jerit, et al., 2006; Knobloch-Westerwick, Carpentier, Blumhoff, & Nickel, 2005; Prior, 2005; Sunstein, 2001) pointed out that increased content diversity coupled with the

growing number of information channels facilitates audience fragmentation. Moreover, the distinct structural features of Web-based news, such as hypertextuality (or nonlinearity), relatively high levels of interactivity, and user control, might encourage selective consumption of information depending on user needs and motivations (e.g., informational need, topical interest) (Tewksbury, 2006; Tewksbury & Althaus, 2000). For instance, individuals who have limited interest in politics and high interest in entertainment information (e.g., gossip, scandal) are likely to choose more entertainment and less political news stories than they might if they were using traditional news outlets. In new media environments exposure to content, particularly political and public affairs information, is fragmented by media user attributes and subsequently information acquisition is also likely to be differentiated.

Purpose of the Current Study

The primary purpose of this study is to empirically investigate the potential for a widening information gap between education groups, driven more clearly by online than newspaper use. Considering that newspaper readership is declining and simultaneously the number of online news users is growing, this is a pressing issue in democratic societies. Even though many researchers agree that the explosion of information volume and source diversity created by new media would exacerbate the existing information disparities, past research has not adequately compared the relative size of education-based information gaps across new and old media. Instead, preceding studies on learning from new media focused on either different information acquisition from old and new media (typically print vs. electronic) (D'haenens, et al., 2004; Eveland & Dunwoody, 2001b; 2002; Eveland, et al., 2002; Tewksbury & Althaus, 2000) or different information access across social groups (by education, SES, region) (Bonfadelli, 2002; Bozionelos, 2004; Hargittai & Hinnant, 2008; Jung, Kim, Lin, & Cheong, 2005; Jung, et al., 2001; Kenski & Stroud, 2006; van Dijk & Hacker, 2003; Willis & Tranter, 2006). Recently,

researchers started to examine education-based knowledge gaps across different news media in a single study with survey methods (e.g., S. H. Kim, 2008) and experiments (e.g., Grabe, Kamhawi, & Yegiyani, in press; Grabe, Yegiyani, & Kamhawi, 2008).

Most traditional knowledge gap studies have been primarily concerned with differential knowledge gain among people from different levels of the social hierarchy (see Gaziano, 1983, 1997; Viswanath & Finnegan, 1996 for reviews). These studies emphasize social structural factors as the fundamental causes of the knowledge gap phenomenon. The fact that survey methods are used in the majority of studies means that mostly correlational relationships between education levels and knowledge levels are reported. A few recent experiments might contribute to more thorough examination of knowledge acquisition by employing several memory measures (e.g., Grabe, Lang, Zhou, & Bolls, 2000; Grabe, et al., in press; Grabe, et al., 2008). Indeed, the primary goal of these experimental studies is the investigation of underlying cognitive mechanisms to explain knowledge gap occurrences. The current study tries to adopt the strengths of both survey and experimental research traditions. Specifically, this study follows the survey research tradition by emphasizing social structural aspects of the knowledge gap phenomenon and using professionally produced news as stimuli. The current study also follows the experimental research tradition by employing controlled procedures and elaborate knowledge acquisition measures in order to investigate the knowledge gap phenomenon in a rigorous manner.

The current research also attempts to make a contribution by examining aspects of the knowledge gap that have been overlooked in past research. Specifically, this study places emphasis on different exposure preferences (public affairs vs. entertainment news) among media users. According to some knowledge gap researchers (Eveland & Scheufele, 2000; D. M. McLeod & Perse, 1994; Neuman, et al., 1992; Price & Zaller, 1993) including the original

research team of Tichenor, Donohue, and Olien (1970), one of the factors responsible for the knowledge gap phenomenon is different news exposure levels across high and low education (or SES) groups. People with higher levels of education are likely to actively seek information about important public affairs issues whereas less educated citizens might prefer entertainment information when they use news media (Eveland & Scheufele, 2000). In the current study, media user preferences for news content based on education level were empirically examined because it is expected to affect information acquisition. It is notable that audience exposure preferences might be influenced by the type of news media they use as well as their formal education level. Thus, news exposure was also investigated across two distinct news formats (newspaper vs. online news). The current study is likely to contribute to our understanding of how people with different educational backgrounds choose news stories and acquire information from different news presentation modes with distinctive features.

Theoretical and Methodological Importance of the Study

At the heart of knowledge gap research lies the observation that differential knowledge gain based on education (or SES) widens (sometimes narrows) through intervening variables, typically time lapse (Eveland & Scheufele, 2000; Gaziano, 1983). It is well established that people with higher levels of education, who typically possess better information processing skills (Cho & McLeod, 2007; Eveland & Scheufele, 2000; Grabe, et al., 2000; Jerit, et al., 2006; S. H. Kim, 2008; D. M. McLeod & Perse, 1994) and broader and deeper background knowledge (Price & Zaller, 1993; Tichenor, et al., 1970), acquire more information than less educated people as new information becomes distributed through media. What seems critical in knowledge gap research is the inclusion of additional variables that are expected to influence the relationship between education (or SES) and knowledge acquisition into research designs (Eveland & Scheufele, 2000; Gaziano, 1983). Roughly speaking, three factors have been identified as

important intervening variables: time, issue publicity, and news media use (Eveland & Scheufele, 2000). These factors are closely associated with distinct methods of testing the knowledge gap. First, as a longitudinal method, education-based knowledge acquisition can be tested over time (at least two points of time) as the overall media publicity on a certain issue increases (Tichenor, et al., 1970). From this knowledge gap test, a stronger positive correlation between education and knowledge level is predicted at the second point of time compared to the first one. In addition to this longitudinal method, Tichenor et al. (1970) also suggested an alternative cross-sectional method for testing the knowledge gap hypothesis. That is, to examine the correlation between education and knowledge acquisition across topics highly and less publicized in media. With this approach, it is hypothesized that issues receiving more media coverage will be associated with larger knowledge gaps than issues less featured in the media spotlight. Eveland and Scheufele (2000) proposed another method for testing the knowledge gap phenomenon. They posited that media use (light or heavy) in conjunction with the education variable can provide a knowledge gap test at any given point in time. Beginning with McLeod, Bybee, and Durall (1979), a number of researchers have adopted this method in knowledge gap research (e.g., Eveland & Scheufele, 2000; Grabe, et al., 2008; S. H. Kim, 2008; Kwak, 1999).

With some resemblance to the third method of testing for knowledge gaps, the study reported here adopted media use as an individual level variable expected to influence information gain across high and low education groups. In addition, this study employed news media type (online vs. newspaper) as a macro level factor expected to have influence on knowledge gap formation. In fact, this line of research, or relative difference in the knowledge gap derived by news media type, has received a lot of research attention from the outset (see Donohue, Olien, & Tichenor, 1987; Donohue, Tichenor, & Olien, 1973; Eveland & Scheufele, 2000; S. H. Kim, 2008; Kwak, 1999; J. M. McLeod, et al., 1979; Neuman, et al., 1992).

Although a few recent studies included online news as a media type (e.g., Grabe, et al., in press;

S. H. Kim, 2008), the majority of these studies were concerned with comparing television to newspaper use. As Eveland and Dunwoody (2001a) pointed out, the knowledge gap theory can serve as an important theoretical framework for the body of research on “learning from new media”—which in return stimulates knowledge gap research agendas.

This study attempts to bridge the macro and micro level aspects of the knowledge gap phenomenon. After formulation of the original knowledge gap theory, a number of researchers (e.g., Ettema & Kline, 1977; Genova & Greenberg, 1979) have explained knowledge gaps at the micro level, focusing on individual differences such as topical interest rather than macro social level factors such as education or SES. Growing variance in levels of analyzing the knowledge gap phenomenon reflects the development of the original hypothesis into a theory (Paisley, 1972). Once the level of analysis for a particular theory moves to a micro plane (e.g., from social to individual), however, the theoretical assumptions of the original theory, as its fundamental basis, are not likely to be sustainable. Thus, the derived model (or theory) does not share the same theoretical concerns with the original model, even though both models (or theories) try to explain the same phenomenon. The current research is in line with the original knowledge gap model in that it regards social structural factors represented by education as the underlying cause of the knowledge gap. This study also includes media type (newspaper vs. online news) as another important macro level variable expected to influence audience knowledge acquisition. It is important to note that media users in this study were allowed to choose news stories depending on their personal preferences. This means that news exposure was examined at the individual level, giving participants free reign over news selection (public affairs and entertainment) but experimentally controlling the media condition (newspaper vs. online news) they were assigned to. In this sense this dissertation stands at the intersection of important social (education and media type) and individual level (topical selection) factors and pursues knowledge acquisition across several measures.

What distinguishes this study from past knowledge gap research is the number and the topical diversity of issues included in the experimental stimuli. With few exceptions (e.g., Jerit, et al., 2006), previous research tested knowledge gaps with a single issue or a composite measure of a couple of topical issues. As Moore (1987) pointed out, because a particular issue is diffused to the public in a curvilinear (i.e., s-curve) rather than linear manner, the point on the curve at which data is collected is critical in testing the knowledge gap hypothesis. That is, depending on the selected points of time, knowledge gaps seem to be either increasing or declining. Additionally, a number of researchers (Chaffee & McLeod, 1973; Donohue, Tichenor, & Olien, 1975; Genova & Greenberg, 1979; Lovrich & Pierce, 1984) note a “ceiling effect” which is prominent among more educated people. Ceiling effects are likely to occur either when information saturation on a particular issue is achieved in the overall media system or when a critical number of the high education group has attained sufficient information on an issue which renders more information unnecessary. Rather than focusing on a single or a few topical issues, this study tested the knowledge gap with a variety of issues featured in a daily newspaper on a particular day. By using a composite knowledge acquisition measure consisting of diverse topics with different levels of salience within the newspaper and in the overall publicity across the whole news media landscape, it is possible to exclude at least partially the effects of the diffusion curve and ceiling effect.

The current study has a couple of additional methodological strengths compared to past knowledge gap research. First, this study employed multiple measures of knowledge acquisition, including memory and comprehension tests. A number of researchers (e.g., Bonfadelli, 2002; Dervin, 1980; Woodall, Davis, & Sahin, 1983) have criticized the ways of conceptualizing and quantifying “knowledge” in the knowledge gap literature, primarily because many studies examine issue awareness or factual knowledge about a given topical issue rather than in-depth understanding or comprehension of the particular issue. It is notable, however, that conceptual

distinctions between understanding and remembering news content have been made by a number of scholars (Gaziano, 1997; Ortony, 1978; Robinson & Levy, 1986; Snoeijer, de Vreese, & Semetko, 2002; Woodall, et al., 1983). Yet, the body of literature that informs our understanding of how citizens acquire information from news media rarely offers findings of multiple memory measures within one study. This study used multiple memory measures that encompass awareness (recognition of story exposure), factual information (free recall), and understanding (comprehension) of news stories. Having multiple measures in one study allows for a more nuanced investigation of knowledge gap formations.

The current study examined media user exposure to news by employing behavioral measures as well as self-reports. Even though the measurement validity of self-reported media use has been questioned (Bechtel, Achelpohl, & Akers, 1972; Curtain, et al., 2007; Knobloch-Westerwick, Carpentier, et al., 2005; Martinelli & Chaffee, 1995; Price & Zaller, 1993; Steiner, 1966; Tewksbury, 2003, 2006), studies often employ this method of data collection through in-person or telephone surveys or media diaries (Papper, Holmes, & Popovich, 2004). Even experimental researchers often depend on self-report measures of media exposure. Due to technological developments, particularly in new media, a couple of recent studies (Curtain, et al., 2007; Knobloch-Westerwick, Carpentier, et al., 2005; Tewksbury, 2003, 2006) examined online news exposure patterns in a more reliable way. Specifically, they observed exposure behavior with the log files of page view chronologies programmed in advance. The current study adapted the same technique for the behavioral measure of online news users. News exposure to print media has typically been examined through self-reports (e.g., Eveland & Dunwoody, 2002; Tewksbury & Althaus, 2000; Althaus & Tewksbury, 2002), with some exception (e.g., Zillmann, Knobloch, & Yu, 2001) where recording devices were used for observing participant behavior. Moreover, some researchers (D'haenens, et al., 2004) have asked participants to mark news

stories they read on newspaper pages to examine the exposure order and the exact point to where each story was read.

The study reported here employed an alternative method for measuring exposure behavior of newspaper readers. Trained observers recorded the chronology and exact time participants spent with each page of the newspaper on log sheets. By doing so, the exposure behavior of newspaper readers was observed in a relatively unobtrusive way. As Papper et al. (2004) pointed out, multiple measures of media use and comparisons among them in a single study are rare. For the purpose of comparison with behavioral measure scores, self-reported news exposure was also examined in this study. Findings from the two distinct measures of news exposure might offer meaningful insights for future research, both theoretically as well as methodologically.

The body of this dissertation consists of four additional chapters. Chapter 2, “Literature review and hypotheses,” introduces the theoretical framework of this study and provides a review of relevant past research. This chapter also features the research hypotheses derived from the literature review. The third chapter describes the research method employed to test hypotheses. Specifically, it presents the research design, experimental manipulations, dependent measures, and data collection procedures. The results are reported in Chapter 4 while the final chapter offers discussion of these results. Limitations of the current study and suggestions for future research are also addressed in the final chapter.

CHAPTER 2

Literature Review and Hypotheses

This chapter introduces the theoretical framework of the current study and offers a review of the past research relevant to this study. Research hypotheses based on the literature review are also presented in this chapter. As stated in the introduction, this research project is concerned about both social level information gaps and individual level variance in learning from media, particularly related to new media use. Hence, the literature review consists of two parts, each focusing on macro and micro level issues relevant to this study. The first part, concentrated on information gaps at the social level, is organized in three subsections. The first section introduces the knowledge gap theory as the overarching theoretical framework of this study. The second section reviews refinements on the original knowledge gap theory by focusing on different models for assessing knowledge gaps as well as the effects of different kinds of media on knowledge gaps. The third section reviews literature and builds the case for looking into audience exposure preferences in studying the knowledge gap phenomenon—something that has been overlooked in past research.

The second major part of this chapter also comprises several subsections. First, the debate over content versus delivery mode—whether learning across distinct types of media is confounded with content—is introduced and this study is positioned in terms of this debate. The second section takes stock of defining features of the World Wide Web, as a representative format of new media, with the potential to influence user learning. Third, online news, as a central new media component of this study, is compared with newspapers in terms of structural features and editorial cues of news story importance. The fourth section focuses on the most prominent feature of online news (i.e., user control) in comparison to traditional news formats. The implications of varying levels of user control for cognitive load and other information

processing dimensions are discussed. The last section reviews the effects of “prior knowledge” on learning. This is indeed an important individual level factor that has been shown to influence media user learning performances.

At the Social Level: Information Gaps

Reconsidering the Original Knowledge Gap Theory

Early studies on information diffusion identified the difficulty of informing some segments of the population, particularly less educated people (see Gaziano, 1983 for a review). Hyman and Sheatsley (1947) referred to this group of people as “chronic know-nothings,” and Spitzer & Denzin (1965) coined the “know-nothing” hypothesis. As such, unequal information acquisition of people with different educational backgrounds is a long-standing concern among social science researchers. This problem has been addressed in research with the arrival of every new medium including newspaper, radio, and television (van Dijk, 2000). Tichenor and his colleagues (1970) formulated this social problem as the knowledge gap hypothesis, based on empirical research which demonstrated the “apparent failure of mass publicity to inform the public at large” (p. 170). That is, “media campaigns generally reach precisely those least in need of it, namely the already motivated and informed segments” (Bonfadelli, 2002, p. 67).

The essence of the knowledge gap theory is captured in the following well-known phrase: “...as the infusion of mass media information into a social system increases, segments of the population with higher socio-economic status tend to acquire this information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease” (Tichenor, et al., 1970, p. 159). Unequal dissemination of information, favoring already privileged groups, runs against the democratic ideals of equality and informed citizenship (Bonfadelli, 2002; Delli Carpini & Keeter, 1996; Grabe, et al., 2000; Verba,

Schlozman, & Brady, 1995). It is noteworthy, however, that the knowledge gap theory acknowledges that people who belong to low SES (Socio-Economic Status) groups do acquire knowledge. In fact, the theory predicts that lower SES groups do obtain knowledge but at a significantly slower rate, compared to their higher SES counterparts (Olien, Donohue, & Tichenor, 1983; Tichenor, et al., 1970).

Beginning with Tichenor and his colleagues, researchers (Bonfadelli, 2002; Eveland & Scheufele, 2000; Grabe, et al., 2000; D. M. McLeod & Perse, 1994; Price & Zaller, 1993; Tichenor, et al., 1970; Viswanath, Kosicki, Fredin, & Park, 2000) have attended to underlying individual and social-level factors that might be responsible for the widening information gap between different sectors of the population. From an early knowledge gap study by Tichenor et al. (1970), five factors were identified to differentiate more educated from less educated people.¹ First, those with higher levels of formal education are expected to have better information processing skills. More opportunities for learning and training are believed to enhance abilities for not only more effective but also more elaborated information processing (Cho & McLeod, 2007; Eveland & Scheufele, 2000; Grabe, et al., 2000; Jerit, et al., 2006; S. H. Kim, 2008; D. M. McLeod & Perse, 1994). Second, prior knowledge has been considered as an important contributor to differential knowledge gain. Highly educated people are generally more knowledgeable about public affairs either through more exposure to news media or higher levels of formal education. Those already better informed on a variety of public affairs issues are better

¹ This study will use education instead of SES as a main independent variable, as many past empirical studies did. As a multifaceted concept, SES encompasses several sub-dimensions such as education, income, and occupation. Yet, education has been most frequently used as a single indicator of SES in past research. This is partly because compared to other SES sub-concepts, education is relatively easy to measure and produces few no responses and vague answers. Given the strong correlations between education and other SES variables and its relatively easy quantification, education seems to be a reliable indicator of SES (see Gaziano, 1997 for reviews).

prepared for comprehension (Tichenor, et al., 1970) through well-organized schemas that facilitate efficient processing of related information (Eveland & Scheufele, 2000). Third, variance in social networks across people with different educational backgrounds is likely to affect knowledge gaps. Higher education groups who generally have better interpersonal networks are expected to have more chances to discuss public affairs issues with others who are also well-informed. This interpersonal communication can be regarded as additional opportunities for learning about public affairs besides news media exposure (Bonfadelli, 2002; Eveland & Scheufele, 2000; D. M. McLeod & Perse, 1994). Forth, it is expected that more educated citizens are exposed to different types of information through news media use than less educated ones. Specifically, individuals with higher levels of education are socialized to actively pursue public affairs information (Clarke & Fredin, 1978; D. M. McLeod & Perse, 1994; Neuman, et al., 1992; Price & Zaller, 1993) and accordingly their exposure to such information might be relatively high. On the other hand, less educated citizens are more likely to consume entertainment news stories during exposure to news media (Eveland & Scheufele, 2000). Lastly, media systems are seen as contributing to the knowledge gap phenomenon. Generally, newspapers are regarded as a more information-rich (particularly for public affairs) medium than television, and preferred by better educated news consumers (Neuman, et al., 1992). This trend might be due to economic and/or motivational factors (Eveland & Scheufele, 2000). First, the cost of subscribing to newspapers might discourage people with lower socio-economic status to do so. Second, newspapers feature content aimed at middle and upper class readers because they are the primary target audience of advertisers (Donohue, Tichenor, & Olien, 1986). Third, to acquire meaningful knowledge from newspapers a relatively high level of literacy is required (Eveland & Scheufele, 2000; Graber, 1994; Kleinnijenhuis, 1991). It is therefore not surprising that people with lower SES struggle to gain information from newspapers compared to higher SES groups.

Based on the preceding discussion of literature on the factors that contribute to the knowledge gap phenomenon, the basic knowledge gap hypothesis will be tested, as the starting point for this study.

H1: There will be a main effect for audience education on knowledge acquisition such that the high education group will outperform the low education group.

Further Development of the Knowledge Gap Theory

SES vs. motivation. After the formal knowledge gap hypothesis was presented in 1970, subsequent research has developed the original model by specifying contingent conditions under which knowledge gaps are expected to widen or narrow (Rucinski, 2004). Tichenor et al. joined this line of research (Gaziano, 1983). Some of these studies provided alternative models for explaining the knowledge gap phenomenon, including the idea that knowledge gaps do not primarily originate from different levels of SES. Media user motivations were identified as important factors in accounting for knowledge gaps. This position is distinguished from the original proposition, in that it focused on individual level factors rather than social structural dimensions (Kwak, 1999).

Three distinct models can be identified from past research, depending on the relationship between SES indicators and motivational factors (Bonfadelli, 2002; Kwak, 1999). Kwak (1999) named these three models causal association, rival explanation, and motivation-contingency; Bonfadelli (2002) named them deficit, difference, and contingency models. For the purposes of this dissertation, the three models are labeled mediation, competition, and moderation models, respectively. First, the mediation model positions an individual's motivation to seek information (e.g., issue interest) as being causally related to socioeconomic status. More specifically, motivational variables are theorized to mediate the relationship between SES factors and

knowledge acquisition. This model, which added nuance to the knowledge gap formation process, is an extension of the original model by inserting a processing variable into the model.

Interestingly, the original formulators of the knowledge gap hypothesis anticipated the possible statistical association among education level, interest, and knowledge retention of information (Kwak, 1999).

Second, the competition model attempted to reformulate the original knowledge gap thesis. According to this model, gaps in knowledge acquisition are more attributable to different levels of motivation among individuals to seek information than their SES or education levels (Bonfadelli, 2002; Gaziano, 1983). Beginning with Ettema and Kline (1977), a number of researchers (e.g., Brown, Ettema, & Luepker, 1981; Genova & Greenberg, 1979; Lovrich & Pierce, 1984) tried to demonstrate that motivation is more important than SES in accounting for the knowledge gap phenomenon. While the mediation model considers motivational factors as dependent on SES such that the higher the education the greater the motivation, the competition model treated them as separate independent variables (Kwak, 1999).

Third, the moderation model is based on the assumption that knowledge acquisition across different SES groups do not always widen as the information flow increases. This model considers motivational factors as moderating the influence of SES variables on knowledge gain (Bonfadelli, 2002). Specifically, for certain topical issues, individuals with higher levels of motivation to be informed are likely to show smaller SES-based gaps than what may be observed among those with lower levels of motivation. In other words, high motivation to gain information about specific topics might eliminate the main effect for SES on knowledge acquisition. This model received most attention among knowledge gap researchers (Kwak, 1999). Tichenor et al. joined in the efforts to uncover conditions that would make knowledge

gaps grow or shrink (Donohue, et al., 1975; Olien, et al., 1983; Olien, Donohue, & Tichenor, 1984; Tichenor, et al., 1970; Tichenor, Rodenkirchen, Olien, & Donohue, 1973).

Even though less educated people are often as motivated to acquire knowledge about issues of interest as more educated people (moderation model), interest in political and public affairs information positively correlates with educational level (McCombs & Zhu, 1995; D. M. McLeod & Perse, 1994; Price & Zaller, 1993) as the mediation model proposes. Empirical findings have shown that prior knowledge about politics and public affairs is closely associated with interest in public affairs (Bennett, 1995; Delli Carpini & Keeter, 1996; Marcus & MacKuen, 1993) and information seeking behavior (Neuman, 1986; Luskin, 1990). Some past research (e.g., Genova & Greenberg, 1979; Kwak, 1999; Lovrich & Pierce, 1984) has also tested the relative strength of SES factors versus individual level motivational factors for explaining knowledge gaps. Motivational factors emerged as potent predictors of knowledge gaps. It is noteworthy, however, that recent knowledge gap studies (Grabe, et al., 2000; Grabe, et al., in press; Grabe, et al., 2008), which investigated knowledge gaps with controlled experimental procedures, have found that the influence of education on knowledge acquisition was robust after controlling for motivational factors.

One possible explanation for why the competition model seems to provide a powerful explanation for knowledge gaps (i.e., motivational factors had a stronger explanatory power than SES variables) might be that almost all past studies tested knowledge gaps with a single, or at best a couple of, topical issues. If knowledge gain across different SES groups is investigated across a wider range of news topics, the mediation model might surface with stronger explanatory power than the other two models. Even though the direction of causality in the relationships among prior knowledge, interest, and communication behavior is unclear and might be reciprocal (see Eveland, et al., 2005; Price & Zaller, 1993 for comprehensive discussions), it

seems apparent that these three factors are strongly related one another. That is, prior knowledge might result in more interest in public affairs news and therefore lead to heavy consumption of public affairs information. After all, higher education groups have consistently been shown to have wider and deeper prior knowledge and higher interest in public affairs, compared to lower educated people. In this dissertation knowledge gain among people with different educational backgrounds was tested on a wide range of public affairs topics instead of focusing on a single or small number of selected topical issues (see the method chapter for details).

Different media effects. In refining the knowledge gap theory, a number of researchers (Donohue, et al., 1987; Donohue, et al., 1973; Eveland & Scheufele, 2000; Grabe, et al., in press; Jerit, et al., 2006; S. H. Kim, 2008; Kwak, 1999; J. M. McLeod, et al., 1979; Miyo, 1983; Neuman, et al., 1992) have attended to the influence of different media, mainly newspapers and television, on knowledge acquisition across different SES groups. The possibility that media might vary in their impact on knowledge gap formation was suggested at the outset of knowledge gap research (see Tichenor, et al., 1970). As discussed earlier, newspapers are favored by middle and upper classes due to cost as well as content and therefore this medium has been seen as widening the knowledge acquisition gap across different SES groups (Tichenor, et al., 1970; Eveland & Scheufele, 2000; Donohue, et al., 1986). In other words, as the publicity of certain issues in newspapers increases, the gap in information acquisition on those issues grows between high and low SES groups.

In contrast, a growing body of literature (Eveland & Scheufele, 2000; Grabe, et al., in press; Jerit, et al., 2006; Kwak, 1999; J. M. McLeod, et al., 1979; Miyo, 1983; Neuman, et al., 1992) has suggested that television news has the potential to narrow knowledge disparities. Television news seems to be conducive to informing lower classes (Eveland & Scheufele, 2000). Unlike print media, television use is not dependent on audience education level (Tichenor, et al.,

1970), making this medium the primary source of news information for less educated people (Donohue, et al., 1987). Television news content is cognitively more accessible to lower education groups who also typically have lower levels of prior knowledge than high education groups (Neuman, et al., 1992). Moreover, the limited volume of hard news in television newscasts prevents those with highly developed cognitive skills and prior knowledge (generally more educated people) from acquiring information beyond what they already have (Eveland & Scheufele, 2000). Thus, television news use can reduce the knowledge gap across different education groups.

As such, different news media are likely to influence the knowledge gap phenomenon in different ways. Considering the growing popularity of the Web as a news medium, it is important to empirically investigate whether the Web has the potential to widen or narrow information gaps. Recently, researchers started to test the effects of the Web on information inequity across people with different levels of education (e.g., Grabe, et al., in press; S. H. Kim, 2008). Findings from this growing body of research show that the Web contributes to increasing the gap in knowledge gain, similar to the findings for the influence of newspapers.

The study reported here can be differentiated from most prior work in terms of two important points. First, a controlled experimental method was used to examine the causal relationship between education and knowledge acquisition. Second, knowledge gaps were compared across old (newspaper) and new media (online news). By doing so, it was possible to examine whether the Web as a newer news medium has the potential to exacerbate the preexisting knowledge gap created by older media.

Exposure Preferences

The knowledge which the original knowledge gap theory refers to was limited to information about public affairs and science (Tichenor, et al., 1970). According to the formulators of the knowledge gap hypothesis, possessing public affairs knowledge is critical to an informed citizenry and their social empowerment (Donohue, et al., 1987; Olien, et al., 1983). Historically, knowledge has been used as a means of social control (Olien, et al., 1983) and in modern democratic societies, citizens act on their knowledge of public affairs by engaging in political decision-making and public policy formation (D. M. McLeod & Perse, 1994). Despite the emphasis on providing citizens of democratic societies with public affairs information, entertainment comprises a substantial portion of news media content (Project for Excellence in Journalism, 2004). Indeed, entertainment is one of the main functions of media (Wright, 1960), including news media. Thus, this dissertation is focused not only on public affairs knowledge gain but also on entertainment information gain among different sectors of society. In this study, public affairs knowledge means socially important information, necessary for citizens to perform surveillance of expanded as well as their immediate worlds (e.g., information on political, national, and international affairs). Entertainment knowledge is defined as information acquired and utilized mainly for the purpose of pleasure, diversion, or as a pastime (e.g., information on sports and show business, gossip about celebrities).

As the original knowledge gap theory predicts, people with lower levels of education acquire public affairs knowledge at a considerably slower rate than those with higher levels of education even though they are most in need of such empowering knowledge. More importantly, as many researchers pointed out, what lower SES groups learn from media is mainly entertainment (e.g., gossip, rumor, and folklore), not socially important information (Childer & Post, 1975; Eveland & Scheufele, 2000; Gaziano, 1983; Price & Zaller, 1993). In other words, different education levels produce a gap in news media use and subsequent knowledge

acquisition such that people in low education groups tend to prefer entertainment, while the more educated favor hard news (Eveland & Scheufele, 2000).

Different exposure preferences across education groups can help explain a seemingly contradictory trend in the political communication area. Despite dramatic growth in the number of political information sources and increases in the average number of years of formal education among citizens, the level of political knowledge across populations remained constant over time (Delli Carpini & Keeter, 1996). It is important to note though that stable averages do not mean the same distributions over time. Overall, political knowledge has increased among some segments of the population but decreased among others (Prior, 2005). Wider content selection across media channels promotes selective exposure among media users, which in turn reduces the likelihood of being exposed to political content. This trend appears to be particularly true for those with lower political interest and higher entertainment preference (Sunstein, 2001). This group of citizens are well-positioned to avoid political news, more so than they would have been with limited media content choices (Prior, 2005). As Prior (2005) pointed out, “as media choices increases, content preferences thus become the key to understanding political learning and participation. In a high-choice environment, politics constantly competes with entertainment” (p. 577).

Based on the preceding discussion of the relationship between education level, prior knowledge, and interest in public and entertainment affairs, one can predict that more educated people would pursue public affairs news more actively than less educated people. On the other hand, less educated people are expected to pursue entertainment news more actively than public

affairs news.² Hence, the following two hypotheses were formulated regarding the interaction between audience education and news content.

H2a: There will be an interaction effect for audience education and news content on news exposure such that the low education group will expose themselves to more entertainment than public affairs news, and less public affairs news than the high education group.

H2b: There will be an interaction effect for audience education and news content on knowledge acquisition such that the low education group will acquire more entertainment than public affairs knowledge, and less public affairs knowledge than the high education group.

At the Individual Level: Learning from New Media

The Content vs. Delivery Mode Debate

For the past couple of decades, the question whether different media contribute to different learning outcomes has received attention from a number of scholars. The majority of media comparison studies have focused on audience knowledge acquisition across newspapers and television. Researchers in the educational technology area have also been preoccupied with this research question for more than 20 years. Educational technology researcher, Richard Clark's (1983) controversial article titled "Reconsidering Research on Learning from Media" sparked much research interest in this area. Based on reviews of prior research and his own

² To make predictions about the high education group's exposure preference or knowledge acquisition related to entertainment news, there is no existing theoretical framework. Furthermore, empirical research has shown weak correlations between hard news and entertainment preferences (see Prior, 2003, 2005). That is, those who have a strong preference for hard news do not necessarily dislike entertainment content.

analyses, he argued that “media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition” (Clark, 1983, p. 445). According to him, experimental research which compares learning through one medium with another produces effects for medium that should be regarded as the outcome of another variable (i.e., content, or instructional method in his field), confounded with medium. Clark also opposes the idea that media attributes might make a unique contribution to learning. He asserted that “since they [i.e., attributes] were not exclusive to any specific media and were only associated with them by habit or convenience, they were not ‘media’ variables any more than the specific subject matter content of a book is part of the definition of ‘book.’ ... many different media could present a given attribute so there was no necessary correspondence between attributes and media” (Clark, 1983, pp. 451-452). For the past twenty-five years a number of scholars have joined this debate, which is still in progress (see Clark, 1994; Hagler & Knowlton, 1987; Hastings & Tracey, 2004; Jonassen, Campbell, & Davison, 1994; Kozma, 1991, 1994; Morrison, 1994; Reiser, 1994; Ross, 1994; Ross & Morrison, 1993; Shrock, 1994; see Eveland & Dunwoody, 2001b for reviews).

When conducting empirical research on different effects across media, there is a fundamental dilemma concerning the relationship between media content and delivery mode. This dilemma is closely related to the tension between internal and external validity of research designs (Eveland & Dunwoody, 2001b). If researchers intend to examine learning differences based on the delivery mode while avoiding effects confounded by content, all differences across conditions must be eliminated except for the presentation medium, as Clark (1983) insisted.³

³ For experimental control, some researchers used transcribed television news as experimental stimuli instead of newspaper articles in comparing television news and newspaper (e.g., Gunter, Furnham, & Leese, 1986; Stauffer, Frost, & Rybolt, 1981). However, a transcript of evening news, approximately 22 minutes long excluding commercials, corresponds to a front page of a typical daily newspapers (e.g., *The New York Times*) in terms of informational volume (Furnham & Gunter, 1989; Furnham, et al., 1990).

Despite the high internal validity, results from such research designs are not likely to produce meaningful results for either theory or practice. On the other hand, it is also problematic to compare media that vary considerably in terms of content as well as presentation mode. Significant differences, if found, from this approach (with low internal validity) run the risk of confounded effects from content differences (see Eveland & Dunwoody, 2001a; Ross, 1994). Yet, many researchers have taken the position that findings of different media effects can be meaningful if results are cautiously interpreted (Eveland & Dunwoody, 2001a; Grabe, et al., in press; Kozma, 1994; Morrison, 1994; Shrock, 1994).

Using Clark's delivery truck analogy, we should entertain the idea that all vehicles are not the same (Jonassen, et al., 1994; Reiser, 1994). Indeed, the unprecedented developments in communication technologies for the past couple of decades "transformed Clark's delivery truck into a supersonic jet, affecting learning by getting instruction to its destination faster, fresher, and less expensively than was conceivable in 1983" (Hastings & Tracey, 2004, p. 28). Different from Clark's perspective, currently available media have different capabilities from those several decades ago. For example, even though computers share some capabilities with both television (e.g., display video) and newspapers (e.g., display print text), they make it possible for media users to consume content in a more interactive and non-linear way than traditional media typically do. Of available media, only computers allow access to practically unlimited databases at any time, make virtual classrooms possible, and facilitate interactive multiple-way communications (Hastings & Tracey, 2004). Technological advancements in the communication area seem to support the idea that a medium is distinct from others to the extent that a set of its capabilities is unique from that of other media (Kozma, 1991, 1994; Salomon, 1978). As Hastings and Tracey (2004) pointed out, now is time to go beyond the debate about content versus delivery mode. Indeed, the focus should be on how media influence user learning rather than whether media affect learning.

The origin of the attribute-centered approach in defining media dates back to Cantril and Alport (1935). Recently Eveland (2003) proposed a “mix of attributes” approach in defining media. Based on this approach, each medium is seen as multidimensional in its attributes. In other words, every medium is regarded as consisting of various attributes rather than one salient attribute (e.g., interactivity, linearity). The mix of attributes approach is useful in defining newer media and comparing them with existing media because no medium is treated as unique and novel. Instead, seemingly new attributes of an emerging medium is considered to be “merely a variation on existing media” (Eveland, 2003, p. 398).

Defining Features of the Web

The World Wide Web has its own unique clusters of defining attributes which make it distinguishable from other media. A typical defining feature of the Web is hypertextuality which is a form of information organization (Eveland, 2003; Eveland & Dunwoody, 2001a). As nonlinear structural forms, hypertexts are organized by nodes and links (Conklin, 1987; Khentout, Harous, Doudi, & Djoudi, 2006; Marchionini, 1988; Nelson, 1993; Rouet, 2000). Nodes refer to information units on the Web and are typically presented in the form of pages. Links make connections among separate nodes which are not only organized by links but also accessed through links by clicking on hyperlinks connected to other pages. The Web as the most popular application of the Internet (K. S. Kim, 2001; Rada, 1995) is the largest hypermedia⁴

⁴ Hypertexts and hypermedia can be differentiated by the content of nodes (Eveland & Dunwoody, 2001a; Khentout, et al., 2006; Scheiter & Gerjets, 2007). Strictly speaking, the term “hypertext” is only limited to hypertextual systems consisting of merely text-based nodes. When nodes include multimedia formats such as video clips and audio messages, “hypermedia” is a more exact term. As the use of multimedia is increasing in hypertext systems, hypermedia is becoming a more frequently used term than hypertext (Eveland & Dunwoody, 2001a). These two terms, however, are still being used interchangeably by many researchers. What seems most important in nonlinear media systems is the structure, not the content (Khentout, et al., 2006).

system currently available, created by millions of authors around the world (Eveland & Dunwoody, 2000). Web links represent the essence of hypertextuality by enabling users to jump from one node to another (Conklin, 1987). This novel type of interaction between users and media is called “browsing” (Spiro & Jehng, 1990). In sum, hypertextuality, which involves the extent to which content is ordered in a linear or nonlinear manner, is an important feature of the Web and expected to create significant media effects (Eveland, 2003).

Interactivity is another important feature of the Web (Eveland, 2003; Newhagen & Rafaeli, 1996). Newhagen and Rafaeli (1996) defined interactivity as “the extent to which communication reflects back on itself, feeds on and responds to the past” (p. 6). A capability of a medium, however, should not be confounded with the variability of its use (Kozma, 1994). According to Dubin (1969), an attribute is “a property of a thing distinguished by the quality of being present” (p. 35) while a variable is “a property of a thing that may be present in degree” (p. 35). Even though the Web can be regarded as a more interactive medium than most other media formats, it does not necessarily mean that individual websites always incorporate high levels of interactivity or that different users experience the same amount of interactivity (Eveland, 2003). In other words, interactivity as a variable is integrated differently across websites and used differently across consumers, despite this defining capability of the Web.

Relatively high control provided to users is also an important attribute of the Web (Eveland & Dunwoody, 2001). User control refers to the extent that media users can make their own decisions about the pace and the sequence of presentation, and the range and amount of content presented (Milheim & Martin, 1991). In fact, user control is strongly associated with interactivity and organizational features of the Web (Eveland, 2003). That is, the Web seems to allow more control to its users not only because its organization is nonlinear but also because it facilitates more interactive features than other media do.

Online News vs. Newspaper

Structural features. Web-based news outlets share many traits of a newspaper. First, these two versions of news media have fewer content differences than each of them has with other media. Nearly all news stories featured in print versions of news media also appear in their online versions (Eveland, et al., 2002; Eveland, Marton, & Seo, 2004; Tewksbury & Althaus, 2000), despite the expanded informational volume of the latter due to additional news and features (Althaus & Tewksbury, 2000; Tewksbury, 2003, 2006; Dozier & Rice, 1984; Corrado, 1996). High similarity in content is an advantage in comparing these two media in research because it preserves the internal validity of research designs. Although the Web as a hypermedia system incorporates multimedia features, Web-based news sources are basically closer to newspapers in journalistic format than audiovisual news media such as television (Norris & Sanders, 2003). With regards to interactivity, neither print nor online versions offer highly interactive features, despite the technical capability of high interactivity on the Web (Eveland, 2003).

In terms of organization and structure, the two media show considerable differences as well as similarities. Newspapers are linear in structure with a hierarchy of story order roughly from the front to inside pages based on importance (Graber, 1988). The organization of newspapers, however, allows readers to ignore the linear order because newspapers are composed of independent topical sections (e.g., politics, sports, metro) which in turn consist of separate news stories (Eveland, 2003). These features of the newspaper might also be applied to Web-based news sites. Story headlines of online news outlets are roughly arranged by importance and news stories are clustered in topical menus based on their subject matter (Althaus & Tewksbury, 2002; Eveland, 2003; Tewksbury & Althaus, 2000).

In spite of these similarities, the two versions of news are different in terms of media structure and organization. To put the difference in a simple manner, the organization of online news is index-based whereas traditional newspapers are organized based on stories. Specifically, news story headlines in online news are listed on the homepage and section pages with hyperlinks connected to the news articles (Knobloch-Westerwick, Carpentier, et al., 2005). Without clicking on an indexed headline, all users see is the title of a given news story—for a small number of news stories a short preview of a few sentences and a small-sized picture might be visible (Tewksbury & Althaus, 2000). Despite the fact that readers can read newspapers in any order they want, the organization of the newspaper itself is still linear in principle. On the other hand, the structure of Web-based news is hypertext, essentially nonlinear in nature. In other words, stories presented on online news sites are not organized in a linear manner even though their headlines are roughly arranged linearly according to story importance.

Online news sites provide hyperlinks connected to other related stories either in the text of stories or, more frequently, in a sidebar. Some stories from preceding days are presented to offer the history of the given news story and other related articles are provided for in-depth information (Eveland, Marton, et al., 2004). The nonlinear organization and offered links of online news together not only enable users to jump effortlessly from one story to another but also encourage them to do so, albeit few news consumers actually use these online capabilities (Eveland & Dunwoody, 2002).

Story importance cues. One of the important tasks of newsroom workers is to determine which stories are reported (i.e., which stories are excluded) and how prominently they are featured. Through these journalistic decision-making processes, or gatekeeping, news editors and reporters provide story importance cues to news consumers (Althaus & Tewksbury, 2002; Fico, et al., 1987; Graber, 1984; Heeter, et al., 1989; Thorson, 2008). In newspapers editorial cues

such as the amount of space assigned to a story, the page the story appears on, its headline size and placement on the page, and the size and number of photographs are regarded as signals of the relative importance assigned to a particular story (Eveland, Marton, et al., 2004; Fico, et al., 1987; Knobloch-Westerwick, Sharma, et al., 2005; McCombs & Mauro, 1977; Tewksbury & Althaus, 2000; Wolf & Grotta, 1985). Newspaper readers use these familiar importance cues without much effort in deciding whether a given story deserves their attention. Indeed, readers do see long articles on the front page as more important than short stories featured on the inside pages (Althaus & Tewksbury, 2002).

Most editorial cues employed in newspapers, however, are not appropriate for online news, primarily because of technical variances in news presentation (Tewksbury & Althaus, 2000). First, due to the relatively small size of computer screens compared to newspaper pages, it is important to place as much information as possible within the small area of a computer monitor (Althaus & Tewksbury, 2002). Therefore, visual cues such as large sized headlines or photos are infrequently used in Web-based news. No more than a couple of top stories are presented in bigger font headlines and small sized pictures on the home or section pages (Tewksbury & Althaus, 2000). Other stories are positioned in subordinate lists by topical menu (e.g., politics, sports, international news) or by the time of uploading with little variation in the size of headlines (Eveland, Marton, et al., 2004; Fico, et al., 1987; Heeter, et al., 1989). Second, need for constant updates of online news makes it difficult to arrange news stories by order of importance (Johnson & Kelly, 2003; Tewksbury & Althaus, 2000). That is, articles are often placed in the order of recency rather than story importance. For example, the first story on the international section of online news is not always the most important international news, different from what readers can expect when they pick up a newspaper (Tewksbury & Althaus, 2000). Moreover, the likelihood of posting incorrect information is higher in Web-based news sources than traditional news media (Johnson & Kelly, 2003) because of the emphasis placed on

providing breaking news in a timely manner rather than reporting accurate and balanced news (Arant & Anderson, 2001; Johnson & Kelly, 2003). Third, due to the hypertext organization of the Web (the technology behind online news), users click on headlines to access article pages (Knobloch-Westerwick, Sharma, et al., 2005). In other words, they cannot identify the length of news stories (a news importance cue) before accessing each news story's page.

Many online news outlets, however, do offer some story importance cues. A basic, yet common feature is recommender systems, indicating how many readers have viewed a report (implicit recommendations) or how readers evaluated an article (explicit recommendations) (Knobloch-Westerwick, Sharma, et al., 2005; Thorson, 2008). Studies have shown that these indications of liking or importance, based on audience behavior and judgment, significantly influence news selection among online news users (Knobloch-Westerwick, Sharma, et al., 2005; Thorson, 2008). Yet such audience evaluations do not seem to considerably reflect newsworthiness or social importance. Indeed, a recent (Curtain, et al., 2007) study which compared top rated stories by online news producers and consumers showed little agreement (approximately 7%) between the two groups. Given the relatively low popularity of public affairs news, it seems unlikely that such recommendations would heighten online consumption of public affairs news. Overall, though, online news consumers receive fewer editorial cues about story importance than newspaper users (Fico, et al., 1987; Heeter, et al., 1989; Knobloch-Westerwick, Sharma, et al., 2005; Tewksbury, 2003; Tewksbury & Althaus, 2000; Thorson, 2008).

For traditional news formats, research has produced evidence that prominence cues guide news user decisions about story exposure (Garcia & Stark, 1991; Graber, 1984, 1988; McCombs & Mauro, 1977; Wolf & Grotta, 1985; Zillmann, et al., 2001). For example, in Graber's study (1988) formal editorial cues about story importance were one of the key factors that newspaper readers used in selecting which news stories to read. Specifically, they were more likely to

choose news stories which were closer to the front page, featured with larger headlines and visual cues, and longer in terms of article length. Her study also indicated that reader interests are often more influential in story exposure than salience cues: Crime stories were more frequently selected than international stories, despite their similarity in featured prominence in the paper. Due to the linear structure of newspapers, however, readers typically explore newspapers to find news of interest through page-by-page scanning. Accordingly, the likelihood of incidental exposure to news stories (at least their headlines) on a variety of topics, particularly those placed closer to the front page, is relatively high among print news readers compared to nonlinear news media users (Althaus & Tewksbury, 2002; Heeter, et al., 1989). Indeed, readers tend to start reading the newspaper from the front page which features public affairs news in high volume (Bogart, 1989). Graber's study also showed that more than two thirds of total news reading is focused on the first section where public affairs news such as political, national, and international stories are amply featured. Yet the menu-based structure of online news outlets enables news consumers to identify news stories of interest and turn away from topics of limited interest (Dozier & Rice, 1984; Fico, et al., 1987; Heeter, et al., 1989; Tewksbury & Althaus, 2000).

In survey research, respondents often report they are interested in public affairs news (Bogart, 1989; Schramm & White, 1949; Tewksbury, 2003) and prefer current events to other topical categories such as sports and business (Bogart, 1989; Munro & Weaver, 1977; Stone & Boudreau, 1995). Some studies, however, have found that people are not interested in public affairs as much as other news topics (e.g., crime, sports) (Bennett, 2001; Tewksbury, 2003). A recent study (Tewksbury, 2003) comparing self-reported online news media use (from survey data) and observed media use behavior (from experiment data) suggests that people exaggerate their exposure to public affairs news. Specifically, less than 50 % of experimental participants who accessed experimental news sites actually chose to consume public affairs news at least once during the two months of the experimental period. On the other hand, survey research

respondents reported a considerably higher frequency of public affairs news exposure than experimental participants. For example, more than half of survey respondents reported that they sometimes get international news online, while less than 20% of experimental participants actually did so. An earlier experimental study (Tewksbury & Althaus, 2000) examining different exposure patterns across print and online news sources also found that people expose themselves to less public affairs news from Web-based news outlets than print newspapers.

As such, differences in structural features and editorial cues for story importance in print and online news formats might influence story selection in different ways. Prominent story importance cues and the linear structure of newspapers together encourage its readers to be exposed to public affairs news even for those who have limited interests. On the other hand, less salient editorial cues and the index structure of online news allow more control over news story selection and thereby less accidental exposure to public affairs news. Thus, it can be expected that news media users would be exposed to a greater amount of public affairs news from print than online news sources and accordingly gain more information about public affairs from newspapers than news websites. Two hypotheses in line with this reasoning were formulated for testing.

H3a: There will be a main effect for presentation mode on public affairs news exposure such that print news readers will expose themselves to more public affairs news than online news readers.

H3b: There will be a main effect for presentation mode on public affairs knowledge acquisition such that print news readers will acquire more public affairs knowledge than online news readers.

When it comes to different exposure preferences across different education groups, less educated people are likely to prefer entertainment over public affairs news (Childer & Post, 1975; Eveland & Scheufele, 2000; Gaziano, 1983; Price & Zaller, 1993), as discussed earlier. Coupled with the relatively high control over news story selection in online compared to print news sources, the following two additional predictions can be made.

H4a: For the low education group, there will be a main effect for presentation mode on entertainment news exposure such that they will expose themselves to more entertainment news using the online than newspaper source.

H4b: For the low education group, there will be a main effect for presentation mode on entertainment knowledge acquisition such that they will acquire more entertainment knowledge using the online than newspaper source.

To sum up, due to structural dimensions, online news stories tend to be displayed with similar prominence whereas the same news stories might be featured with an assortment of salience cues in newspapers. Thus, online news users are likely to spend more effort determining which news stories are worth reading. At the same time, the menu-based organization of the online news format allows more user control over news selection than the print news structure. It is important to examine what effects this increased user control and decreased editorial control have on user learning from media.

User Control vs. Cognitive Load

User control theory. A prominent reason why hypermedia is arguably better for learning than print media is that it generally provides high levels of user control (DeStefano & LeFerve, 2007; Eveland & Dunwoody, 2002; Marchionini, 1988). User (or learner) control refers to the extent that users (or learners) can make their own decisions about the pace and the sequence of

information access, and the amount and the range of content presented (Milheim & Martin, 1991). Thus, three subcategories of user control can be identified. First, pace control represents the degree to which users decide the speed of content presentation and the amount of time spent on each content element (Milheim & Martin, 1991). Pace control is a basic level of control, available across a variety of traditional media as well as hypermedia (Scheiter & Gerjets, 2007). Second, sequence control refers to the level of command that users have over the order in which selected content units are represented. Third, content control points to the range and the depth of material that users choose to expose themselves to (Milheim & Martin, 1991). The amount of user control exercised in using an individual medium or during a learning activity can vary ranging from complete user control to complete medium or site control (program control) (Newkirk, 1973). Indeed, the degree of user control typically falls somewhere in the middle of the continuum: with a mixture of some user control and some program control (Milheim & Martin, 1991).

A number of scholars (Kinzie, 1990; Kinzie, Sullivan, & Berdel, 1988; Merrill, 1980; Snow, 1980; Steinberg, 1989; Yang & Chin, 1996-1997; Young, 1996) in the areas of educational psychology and educational technology posited that learner performance can be enhanced when control over decisions in the process of learning is allowed. Learner (or user) control theory rests on the assumption that individual learning styles differ and accordingly the “best way to learn” varies across different learners (Eveland & Dunwoody, 2001b; 2002). Learner control has been associated with a number of positive effects on learning processes such as increased self-efficacy and motivation to learn, enhanced interest in a given subject, reduced anxiety, advanced self-learning abilities, and active attitude formation—all regarded as contributing to better learning outcomes (Kinzie, 1990; Kinzie, Delcourt, & Powers, 1994; Landow, 1997; Milheim & Martin, 1991; Park, 1991; Steinberg, 1989; Yang & Chin, 1996-1997; Yildirim, Ozden, & Aksu, 2001).

According to user control theory hypermedia systems, including the World Wide Web, offer better learning environments compared to other instructional forms such as print media (Barab, Bowdish, Young, & Owen, 1996; Fiderio, 1988; Fredin, 1997; Jacobson & Spiro, 1995; Jonassen, 1986, 1988, 1989a, 1989b; Landow, 1992, 1997; Marchionini, 1988; Merrill, 1980; Spiro & Jehng, 1990). Proponents argue that the flexibility of hypermedia and its interactive features allow learners to create the best learning environment matched with their unique cognitive abilities, background knowledge, interests, and learning styles (Eveland & Dunwoody, 2001b; 2002; Park, 1991). This proposition rests on the assumption that learners have the ability to identify what is most appropriate to them among a wide range of choices. Many scholars (DeStefano & LeFerve, 2007; Dillon & Gabbard, 1998; Milheim & Martin, 1991; Murray, 1998; Park, 1991; Shin, Schallert, & Savenye, 1994), however, have pointed out that learners in high user control environments frequently make poor decisions, particularly those who are not familiar with the subject domain or the instructional media system. In addition to adequate prior knowledge and system experience, learners are required to have meta-cognitive abilities to assess and predict what would be most conducive to learning in user controlled environments (Park, 1991).

In addition to user control theory, hypermedia advocates lean on another important theoretical foundation to build their case for the superiority of hypermedia over traditional media in facilitating user learning. Beginning with Vannevar Bush (1945), the inventor of the hypermedia concept (see Beasley & Waugh, 1996; Conklin, 1987; Eveland & Dunwoody, 2001a; 2002; Fastrez, 2001), a number of researchers (Bieber, Vitali, Ashman, Balasubramanian, & Oinas-Kukkonen, 1997; Carlson & Ram, 1990; Fiderio, 1988; Jonassen, 1986, 1988; Jonassen & Grabinger, 1990; Jonassen & Wang, 1993; Kearsly, 1988; Landow, 1992, 1997; Shin, et al., 1994; Yildirim, et al., 2001) have advanced the idea that hypermedia systems can facilitate learning because its structure emulates the human brain's architecture for memory association.

Eveland and Dunwoody (2002) named this similarity between the human brain and hypermedia organization “structural isomorphism.” Similar concepts, all sharing the basic idea of associative memory, have been developed and used across a variety of research fields. These include, for example, schemas, levels of processing, connectionism, and semantic network (Fastrez, 2001; Eveland & Dunwoody, 2001a; 2002). Many scholars (Dillon, McKnight, & Richardson, 1993; Nelson & Palumbo, 1992; Park, 1991; Tergan, 1997; Whalley, 1990), however, have criticized this approach for oversimplifying human cognition. They asserted that the brain’s architecture is not only more complex but also more dynamic than hypermedia. According to Nelson and Palumbo (1992), “most hypermedia systems support linkages indicating only that one unit of information is somehow related to another unit of information, without specifying the nature of relationship and a rationale for its existence....In contrast, human memory supports a much stronger mechanism that both establishes a relationship and conveys information about the association nature of the link” (p. 290). Even if one accepts the assumption that hypermedia can facilitate learning because of its similarity to brain architecture, it is naïve to expect that organized sets of information in hypermedia would simply be transmitted to a learner’s memory networks (Fastrez, 2001).

Empirical findings do not provide conclusive evidence to support the superiority of hypermedia for learning. Some studies showed higher learning performances in user control conditions (Campanizzi, 1978; Fernald, Chiseri, & Lawson, 1975; Hasler, Kersten, & Sweller, 2007; Kinzie, et al., 1988; Mager & Clark, 1963; Newkirk, 1973), whereas other studies confirmed that lower levels of learning are associated with user control (Balson, Manning, Ebner, & Brooks, 1984-1985; Mayer, 1976; Reiser & Sullivan, 1977; Yang & Chin, 1996-1997). Moreover, a considerable portion of past research found no clear support for either user control or program control as facilitators for learning (Daniels & Moore, 2000; Lanza & Roselli, 1991; Mager, 1964; Merrill, 1975; Murphy & Davison, 1991; Snow, 1980; Tennyson, 1981; Tennyson

& Buttrely, 1980). Related to this matter of control, studies that have compared learning from hypermedia versus linear formats have also produced mixed findings. Some results favored hypermedia (Crosby & Stelovsky, 1994; Frey & Simonson, 1994; Jacobson & Spiro, 1995; Yildirim, et al., 2001) while others supported linear media (Barab, Young, & Wang, 1999; Beishuizen, Stoutjesdijk, & Zanting, 1996; Eveland, Cortese, Park, & Dunwoody, 2004; Miall & Dobson, 2001) as the best format for learning. To make matters worse, even comprehensive reviews on the effects of hypermedia and user control on learning failed to yield consistent conclusions (C. M. Chen & Rada, 1996; DeStefano & LeFerve, 2007; Dillon & Gabbard, 1998; Dillon & Jobst, 2005; Gabbard, 2000; Liberman & Linn, 1991; Ross & Morrison, 1989; Schnackenberg, Sullivan, Leader, & Jones, 1998; Steinberg, 1977, 1989; Weise, 1995). Exceptionally, a meta-analysis conducted by Goforth (1994) asserted the positive influence of user control on learning while another meta-analysis by Niemiec et al. (1996) showed that the average effect size associated with learner control across studies was negative but close to zero. Based on this analysis, Niemiec et al. concluded that “the average student would be slightly better off without it (leaner control)” (p. 157).

In the field of communications, a similar concept to user control, called “selective scanning,” has been used in research on informal learning from news media (e.g., Eveland & Dunwoody, 2002; Kosicki & McLeod, 1990). The process of selective scanning involves choosing and avoiding information depending on media user interests, news importance, and the personal relevance of news items (Eveland & Dunwoody, 2002). Apparently, the primary reason for employing selective scanning is to manage information load. Specifically, the large information volume delivered through news media does not match the limited time and energy resources of the audience (Kosicki & McLeod, 1990). Selective scanning is therefore a selective exposure response from news audiences. In line with the predictions of user control theory, which assume higher levels of control in Web than linear media formats, selective scanning is

expected to be more prominent among Web than traditional news consumers. Empirical findings confirmed high levels of selective scanning during online news use (Eveland & Dunwoody, 2001b; 2002; Knobloch-Westerwick, Carpentier, et al., 2005) and, perhaps more important, lower learning performances for online than print news groups (Eveland & Dunwoody, 2001b; 2002; Tewksbury & Althaus, 2000).

Unlike the evidence in support of user control theory, findings for selective scanning reveal little impact on audience learning, “at least in the context of learning public affairs information from news media” (Eveland & Dunwoody, 2002, p. 39). This discrepancy in empirical evidence across user control and selective scanning research is perhaps attributable to different learning contexts. In the educational technology field, learning is commonly regarded as goal-oriented processes in which most learners are at least moderately motivated and involved. In such formal educational settings, hypermedia systems are carefully designed for specific educational purposes or groups of students to achieve high levels of learning. On the other hand news media, including the Web, provide information in large quantity and in a wide variety of topics to a mass audience (virtually the whole population) in a timely manner. Even though one of the main functions of news media is to inform the public about socially important affairs, the focus is placed on supplying relevant information to as many people as possible. Educating or enlightening the public, as formal education institutions typically do, is a noble goal but certainly not a primary achievement of mass media. News media consumers are seldom highly motivated to learn from news. Indeed, many people use news media habitually (Diddi & LaRose, 2006; LaRose & Eastin, 2004; Rosenstein & Grant, 1997), and they often access news media for purposes other than seeking information (e.g., simple pastime, diversion, or amusement) (see Diddi & LaRose, 2006).

Cognitive load theory. A number of researchers (Fastrez, 2001; Kalyuga, 2007; Khentout, et al., 2006; Last, O'Donnell, & Kelly, 2001; Mayes, Kibby, & Anderson, 1990; Salomon, Perkins, & Globerson, 1991; Scheiter & Gerjets, 2007) have argued that high user control, the essential feature of hypermedia that supposedly facilitates learning, might in fact undermine learning by posing too much cognitive load. The hypermedia structure requires users to maintain relatively high levels of attention during the process of navigation (Conklin, 1987; Fastrez, 2001). That is, hypermedia users spend cognitive resources on deciding which links to follow, how to get to a specific piece of information, and how that particular information (usually in the form of a webpage) is positioned in large informational volume (Conklin, 1987; Eveland & Dunwoody, 2001a; Khentout, et al., 2006; Scheiter & Gerjets, 2007). Conklin (1987) called this demand on resources during orientation “cognitive overhead.” Even though traditional linear media such as books or newspapers also demand orientation resources (Calvi, 1997; Conklin, 1987), hypermedia use generally imposes a heavier cognitive load than print media, for several reasons. First, the sheer volume of information in cyberspace is virtually unlimited (Ozcelik & Yildirim, 2005). Yet the amount of information accessed at a given point in time is limited by the small size of a computer screen, making content fragmentation inevitable (Fastrez, 2001). Second, hypermedia do not provide cues about its physical size or how many nodes and links are included (Ozcelik & Yildirim, 2005; Fastrez, 2001). On the other hand, print media not only allow readers to assess it as a physical entity but also provide readers with spatial clues in the form of page numbers; in the case of books, a table of content enables readers to identify the overall organization of information at a glance (Fastrez, 2001). Moreover, print materials offer a default track for reading (Fastrez, 2001). Thus, even when print media users feel lost inside the myriad of pages, all they have to do is move either forward or backward in the text (Conklin, 1987). This is very different from hypermedia use in which users have countless options provided by the networked structure. Indeed, a number of researchers (Astleitner & Leuner,

1995; Calvi, 1997; S. Y. Chen, 2002; Conklin, 1987; Daniels & Moore, 2000; Darken & Sibert, 1996; Marchionini, 1988; McDonald & Stevenson, 1996; Nielsen, 1990) have been concerned about the feeling of being lost, or “disoriented,” in cyberspace while navigating through hypermedia. As such, it can be said that “a certain level of usability problems is inherent to hypermedia” (Scheiter & Gerjets, 2007, p. 289).

Cognitive load theory (see Chandler & Sweller, 1991; Kalyuga, 2007; Sweller, 1988, 1994, 2003, 2004, 2005; Sweller, van Merriënboer, & Paas, 1998; van Merriënboer & Sweller, 2005) has been adopted by many scholars in explaining how cognitive overload and disorientation created by hypermedia navigation negatively affect learning. This theory assumes that the amount of cognitive resources available in working memory is limited, which serves as an underlying constraint on information processing outcomes including learning (DeStefano & LeFerve, 2007; Kalyuga, 2007). Efficient allocation of cognitive resources across simultaneous tasks is critical to learning (Kalyuga, Chandler, & Sweller, 2001). This perspective is clearly in line with the limited capacity approach to information processing which rests on earlier work by Miller (1956) and Broadbent (1958) and recently was re-appropriated for media research by Lang (2000) and others. According to cognitive load theory, when information from external sources are processed two distinct types of cognitive load are imposed on working memory (Hasler, et al., 2007; Kalyuga, 2007; Sweller, 1994; Sweller, et al., 1998). First, intrinsic cognitive load refers to the challenge inherent in the content of learning materials (Sweller, et al., 1998). Because the size of this cognitive load is determined primarily by the complexity of materials, it is an inevitable part of learning processes (Hasler, et al., 2007; Kalyuga, 2007; Sweller, et al., 1998). On the other hand, the extraneous cognitive load involves how content is delivered to learners rather than the learning process itself (Sweller, 1994). Thus, this type of cognitive load varies depending on the specific method of information delivery. More important, this extra cognitive load either increases through poor learning methods or shrinks due to

effective instructional designs (Bannert, 2002; Hasler, et al., 2007; Kalyuga, 2007). Therefore, extraneous cognitive load has received more research attention from cognitive load theorists and instructional designers (Sweller, et al., 1998) than intrinsic cognitive load. Based on cognitive load theory, learners are likely to experience relatively high cognitive load levels (particularly the extraneous kind) in the demanding hypermedia environment that requires cognitive resources unrelated to the learning process itself (DeStefano & LeFerve, 2007; Eveland & Dunwoody, 2001b; Kalyuga, 2007; Khentout, et al., 2006; Ozcelik & Yildirim, 2005; Scheiter & Gerjets, 2007; Southwell & Lee, 2004).

In short, the high level of user control in hypermedia navigation (online news use, in this study) might create a cognitive burden on users, which might lead to disorientation and lower levels of learning among users. This line of arguing leads to the following hypothesis.

H5a: There will be a main effect for presentation mode on disorientation such that online news readers will be more disoriented than print news readers.

Individual Differences

The inconclusive evidence for the influence of user control and hypermedia use on learning might be partly because of individual differences among learners. Researchers have shown interest in studying moderating factors, or individual differences, which supposedly affect learning processes and outcomes. A variety of individual differences have been investigated, such as gender (Schumacher & Morahan-Martin, 2001), cognitive styles (S. Y. Chen & Macredie, 2004; K. S. Kim, 2001), working memory capacity (Lee & Tedder, 2003), and prior knowledge (Alexander, Kulikowich, & Jetton, 1994; Balcytiene, 1999; Hölischer & Strube, 2000; Last, et al., 2001; Mitchell, Chen, & Macredie, 2005; Potelle & Rouet, 2003; Shin, et al., 1994).

Of these variables, prior knowledge has received the most widespread research attention (Eveland & Dunwoody, 2001a; Mitchell, et al., 2005).

Two types of prior knowledge have been identified as important for learning: system experience (system expertise) and domain knowledge (domain expertise) (Eveland & Dunwoody, 2001a; Mitchell, et al., 2005). System expertise refers to skills relevant to using a media system for learning an instructional method (i.e., content) as well as experience using that particular medium (Mitchell, et al., 2005). With regards to learning from hypermedia, system expertise includes user understanding of the hypermedia structure, general computing experience, and hypermedia use experience (Lazonder, 2000). Domain expertise refers to learner's background knowledge of the content area to be learned (Mitchell, et al., 2005). For example, in the case of the study reported here, acquired information about public affairs corresponds with domain knowledge.

Prior knowledge, either system or domain knowledge, is believed to significantly enhance learning through several cognitive mechanisms. Different from working memory, characterized by its limited capacity, long-term memory is known to store virtually unbounded amounts of information (Jung, et al., 2001; Kalyuga, 2007; Sweller, et al., 1998). Such large quantities of information are organized by schemas or structured chunks of related information (Jung, et al., 2001; Kalyuga, 2007). High levels of prior knowledge mean well-organized schemas—many of them—capable of storing information into long-term memory. When people process information, preexisting schemas are retrieved from long-term memory and activated in working memory, which in turn develop additional schemas as new bits of information from external sources are intertwined with existing schemas (Grimley, 2007). One reason why prior knowledge is critical to learning is the operation of preexisting schemas in triggering working memory (Chi, Glaser, & Rees, 1982), and accordingly reducing the overall working memory

load (Hasler, et al., 2007; Kalyuga, 2007; Kalyuga, et al., 2001; Sweller, et al., 1998). Moreover, well-developed schemas facilitate automation of information processing (Grimley, 2007; Kotovsky, Hayes, & Simon, 1985). With repeated practice, information elements that otherwise require controlled processing can be processed automatically (Sweller, et al., 1998). Such schema automation reduces cognitive load (Kalyuga, 2007; Sweller, et al., 1998).

Empirical studies have offered evidence to show that cognitive overload (or disorientation) during hypermedia use is heightened among less knowledgeable people either due to insufficient system expertise or low levels of domain knowledge (e.g., Last, et al., 2001; McDonald & Stevenson, 1998; Mills, Paper, Lawless, & Kulikowich, 2002). On the other hand, more knowledgeable learners sometimes profit from hypermedia's flexibility (see S. Y. Chen, Fan, & Macredie, 2006; DeStefano & LeFerve, 2007; Scheiter & Gerjets, 2007 for comprehensive reviews). In terms of learning outcomes, hypermedia users with high levels of prior knowledge performed well regardless of the media system they use as well as outperformed those with lower levels of knowledge (e.g., Balcytiene, 1999; Potelle & Rouet, 2003; Shin, et al., 1994). Overall, empirical findings generally highlight hypermedia usability problems salient to people with low expertise rather than the relatively strong learning benefits of hypermedia for more knowledgeable user groups.

In the communication field, particularly the area of learning from media, prior knowledge has also been regarded as an important factor of influence in acquiring new information from news media. Research has shown that citizens who are knowledgeable about politics generally seek public affairs news more actively than people who are less knowledgeable (Neuman, et al., 1992; Price & Czilli, 1996; Price & Zaller, 1993). Moreover, background knowledge enhances media user interest in public affairs (Delli Carpini & Keeter, 1996; Neuman, 1986; Price & Czilli, 1996). Despite the inconsistent directions of causal relationships between prior

knowledge, interest, and communication behavior (see Eveland, et al., 2005; Price & Zaller, 1993 for comprehensive discussions), it seems unquestionable that these three factors are strongly related. Generally speaking, people with high levels of formal education have broader and deeper prior knowledge on a variety of topical issues including public affairs (Price & Zaller, 1993; Tichenor, et al., 1970). As a number of scholars (Ceci, 1991; Cho & McLeod, 2007; Eveland & Scheufele, 2000; Grabe, et al., 2000; Jerit, et al., 2006; D. M. McLeod & Perse, 1994; Price & Czilli, 1996; Wade & Schramm, 1969) have asserted and empirically shown, more educated people have better information processing strategies and cognitive abilities, either innately or learned (Grabe, et al., 2000). After all, it can be assumed that people with higher levels of education have better domain expertise on public affairs information than their less educated counterparts.

When it comes to the relationship between education level and system expertise on hypermedia use, better educated people typically have more experience as well as better system knowledge and skills, compared to less educated people. Empirical studies on the digital divide (Bonfadelli, 2002; Bozionelos, 2004; Nguyen & Western, 2007; van Dijk & Hacker, 2003) have shown significant education-based (or SES-based) gaps in ownership of computer hardware, access to computers and the Web, and digital skills. Moreover, content-specific uses of ICTs were found to be considerably different across education (or SES) groups. Those with high levels of education (or SES) tend to use new media more for informational purposes (e.g., news reading) while less educated (lower SES) groups typically use new information technologies for entertainment purposes (e.g., playing electronic games). This education-based gap in media use also applies to newspaper reading. Generally speaking, less educated people prefer television as their primary news source and do not read newspapers as much as more educated people (Donohue, et al., 1987; D. M. McLeod & Perse, 1994; Neuman, et al., 1992). This means that high education groups have more system experience with newspapers as well as with online

news sources. Taken together, these research findings form the basis for the following hypothesis.

H5b: There will be a main effect for audience education on disorientation such that the low education group will be more disoriented than the high education group.

One important dimension that makes the Web-based news format distinguishable from the traditional newspaper format involves the structural features employed to package news, as discussed earlier. Due to the nonlinear structure of online news, fewer editorial cues about news importance are exerted in the presentation of news stories and users have more control over news selection. These presentation traits have been described as non-beneficial to learning, especially for less educated people. Furthermore, low education groups typically have less experience with the Web, including online news sources, compared to high education groups. When low education groups use online news sources low levels of system experience may exacerbate cognitive disorientation already in play due to lack of domain knowledge (i.e., public affairs knowledge). Based on this reasoning, an interaction effect between presentational mode and education is predicted for disorientation levels.

H6a: There will be an interaction effect such that the low education group will be more disoriented using the online than newspaper source, while the high education group will report no significant difference in disorientation across the two news sources.

Because of their limited prior knowledge less educated people are more susceptible to media-supplied salience cues (Iyengar & Kinder, 1987). The more vivid story importance cues of the newspaper format, compared to online news, could therefore be expected to affect lower education groups to a larger degree than online news importance cues. The index-based presentation of online news enables its users to swiftly identify news stories of interest and

simultaneously ignore news of lesser interest. As a result, less educated people, who typically have limited interest in public affairs, will probably be more likely to avoid this type of news when they use online sites than newspapers. On the other hand more educated people, who generally follow public affairs news closely, are expected to pursue such information regardless of the format of news presentation. Coupled with these expectations of different news exposure across education groups, different levels of system (i.e., hypermedia experience) and domain (i.e., public knowledge) expertise across the two education groups are likely to further influence public affairs information gain. As hypothesis 6a predicted, less educated people with relatively low expertise are expected to experience more navigational problems during hypermedia than print media use, while more educated people with relatively high levels of prior knowledge might not experience such problems. These arguments lead to a prediction that less educated people would show lower levels of public affairs information gain from an online than print news source while more educated people would perform equally well with the two news media. Two final predictions of interaction effects for presentation mode and education are as follows.

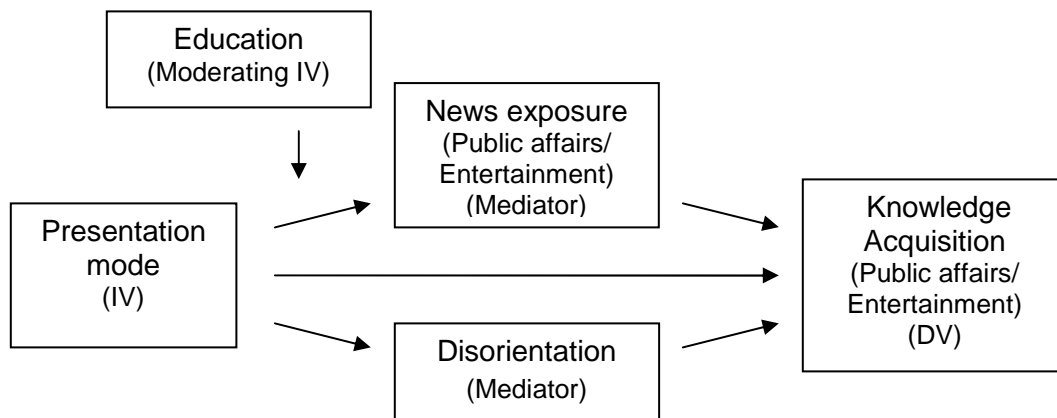
H6b: There will be an interaction effect such that the low education group will expose themselves to less public affairs news using the online than newspaper source while the high education group will be associated with no significant difference in public affairs news exposure across the two news sources.

H6c: There will be an interaction effect such that the low education group will acquire less public affairs knowledge using the online than newspaper source while the high education group will be associated with no significant difference in public affairs knowledge acquisition across the two news sources.

Research Model

This study will employ three independent variables (education, presentation mode, and news content) and three dependent variables (news exposure, disorientation, and knowledge acquisition) to test the hypotheses in the preceding literature review. Of the three independent variables, education is predicted to be a moderating independent variable: When education is high, there might be no significant difference between print and online news groups in terms of public affairs and entertainment news exposure, disorientation, and knowledge acquisition but the low education group is expected to drive variance across dependent and independent variables. Figure 2-1 illustrates the predicted relationships among the main variables in a cursory manner.

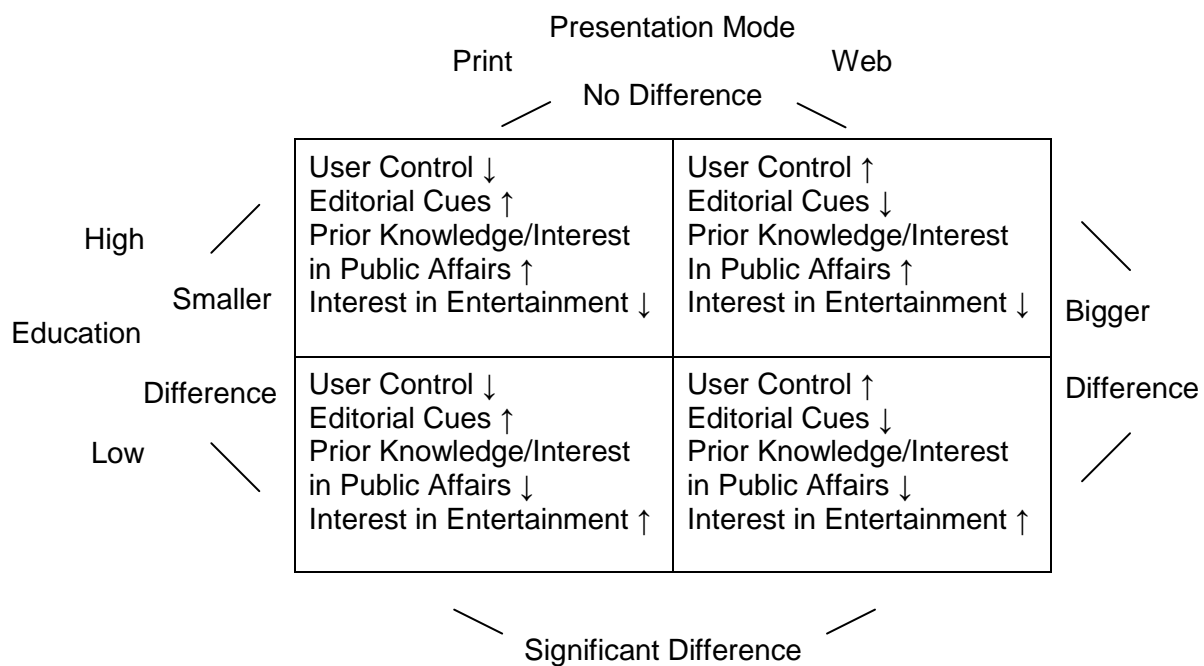
Figure 2-1. Research Model of This Study



As discussed above, the two independent variables (presentation mode and education) are expected to influence dependent variables through interactions. Figure 2-2 graphically shows the research model of this study specifying the interacting relationship of the two factors. All predictions are related to the four cells produced by the two interacting variables. Specifically, the low education print group and low education Web group will be significantly different in terms of news exposure, feelings of disorientation, and knowledge acquisition. On the other hand, the high education print and high education Web groups are not expected to vary

significantly on dependent variables. Inside cells features that may be underlying causes for differences across groups are presented, even though these will not be manipulated or measured as main variables. Of those factors, user control and editorial cues are related to presentation mode while prior knowledge of public affairs and interest in public and entertainment affairs are associated with the education variable.

Figure 2-2. Theoretical Predictions of the Research Model



Note. Difference between groups represents different news exposure, disorientation, and acquisition of public affairs/entertainment knowledge.

CHAPTER 3

Method





The main purpose of this study is to experimentally investigate differences in informal learning from old and new media among media users with different educational backgrounds. Specifically, this research aims to test a potentially widening knowledge acquisition gap between high and low education groups, particularly when it comes to online news use. Traditional knowledge gap research is mostly based on survey research methods, and focused on assessing differential knowledge gains between people from different levels of the social hierarchy. Recently, researchers started to tackle the knowledge gap phenomenon from an individual level of analysis, adopting controlled experimental methods to investigate the underlying cognitive mechanisms that explain knowledge gaps (e.g., Grabe, et al., 2000; Grabe, et al., 2008). The current research project employs experimental procedures but it focuses on exposure preferences (public affairs vs. entertainment news) of participants while also contributing to our understanding of how people with different levels of education gain information from two different news media (newspaper vs. online news).

Design

To test the hypotheses, an audience education (2) x presentation mode (2) x news content (2) mixed factorial experimental design was used. The first two variables (audience education and presentation mode) were treated as between-subjects factors and the third (news content) was employed as a within-subjects factor. All the independent variables have two levels. Audience education factor levels are high and low education groups; the two presentation modes are print (newspaper) and online news; for news content the two levels are public affairs and entertainment news. The two between-subjects factors (audience education and presentation

mode) produce four crossed treatment levels: high education and print news, low education and print news, high education and online news, and low education and online news. Because news content is a within-subjects factor, all participants were exposed to both public affairs and entertainment news. Figure 3-1 represents graphically all three independent variables.

Figure 3-1. Experimental Design

Audience education (Between subjects)	Presentation mode (Between subjects)	
	Print	Online
High	High education/Print  Public affairs/Entertainment (Within subjects)	High education/Online  Public affairs/Entertainment (Within subjects)
Low	Low education/Print  Public affairs/Entertainment (Within subjects)	Low education/Online  Public affairs/Entertainment (Within subjects)

Independent Variables

The three independent variables of this study were represented in the experimental stimuli as well as in participants themselves. Specifically, audience education was controlled by recruiting participants with high and low levels of education. As for presentation mode, two experimental news sources (print and online) were used. In the case of news content, two levels (public affairs and entertainment news) were incorporated in the experimental stimuli of both print and online news.

Stimuli

Media selection. In order to increase external validity, this study used a professionally produced newspaper (i.e., *The Chosun Ilbo*) and its Web-based version (www.chosun.com) as experimental stimuli. *The Chosun Ilbo*, one of the leading daily national newspapers in South Korea, has the largest nationwide readership. Its daily circulation is approximately 2.4 million (Chosun Ilbo on the Web, 2007) and the average number of visitors to its website is more than 6 million per month (Korean Association of Newspapers, 2006a). The status of *The Chosun Ilbo* in the Korean newspaper market is similar to that of *The New York Times* or *The Washington Post* in the U.S. market in that they are widely consumed by readers across the country and influential to other news outlets as well as to their readers. But there is a critical difference between them in terms of the composition of their readers. In the U.S., *The New York Times* and *The Washington Post* are mainly targeted at well-educated upper and middle class citizens and are typically regarded as elite newspapers. Thus, with regard to readability they are relatively inaccessible for less educated people. On the other hand, local papers in the U.S. are usually easier to read and more accessible to less educated news consumers. As for Korean newspapers, national and local papers are not noticeably different in the degree of content accessibility. Instead they differ in the amount of information (i.e., the number of pages), the proportion of local versus national and international news, the market size, and the circulation, not in the demographic characteristics of readers.

In the U.S. a few of several thousand ($\pm 1,500$) daily newspapers are nationally circulated whereas in Korea a dozen of several hundred (± 190) daily papers are distributed nationally (Korean Association of Newspapers, 2006a; World Association of Newspapers, 2005). A handful of those papers, particularly the top three newspapers (*The Chosun Ilbo*, *The Joongang Ilbo*, *The Dong-A Ilbo*) dominate the newspaper market in Korea. Specifically, the top three

papers account for 49% (6.5 million of 13.2 million) of total daily newspaper circulation and *The Chosun Ilbo* alone has 18% of the market share (Korean Association of Newspapers, 2006a). On the other hand, in the U.S. the 12 largest papers, each circulating half a million or more, make up only 20% (10.9 million of 54.6 million) of all circulation. *USA Today* alone, which has the largest daily circulation, only has 4.2 % of the market share (World Association of Newspapers, 2005).

Given the wide distribution and the large market share of *The Chosun Ilbo*, the participants of this study might have considerable pre-exposure to the paper. Thus, it seems likely that participant familiarity with the experimental stimuli might influence their responses. Thus, an alternative approach, using a local paper from a market outside of Seoul (where this experiment was conducted) was considered. This option, however, might pose a more serious problem. If participants are exposed to an unfamiliar newspaper, the novelty of reading the unknown local newspaper might affect responses. Considering that one important purpose of this study is to investigate how participants expose themselves to news stories, using a familiar medium might enhance ecological validity. More importantly, of the two possible confounding factors, familiarity is easier to control statistically than novelty. In fact, participants were asked to report how often they consume news from *The Chosun Ilbo* and its website and these measures were included as covariates during the analysis to control for familiarity (see “Media use variables as covariates ” below).

Stimuli preparation. Using professionally produced online news increases the ecological validity of experimental research. Yet, frequent updates make for inconsistent stimuli across the data collection period. Thus, if the experiment is conducted across several days, participants on different days will be exposed to different Web news stories. Therefore, a static version of *The Chosun Ilbo* online site was built for this study. This site was very similar to *The Chosun Ilbo*

website and matched that day's print version of *The Chosun Ilbo*. In addition to the homepage and news articles, advertisements were also downloaded and included in the site as they appeared on the original site.

A recommender system, i.e., "most viewed" was included as well, as it is likely to serve as a news importance cue to online news users in the same way that editorial cues such as the headline size and the article length do for newspaper readers (Knobloch-Westerwick, Sharma, et al., 2005). Incorporating these elements (i.e., advertisements and a recommendation) is necessary to equalize the two presentation modes in terms of distraction and salience cues. On the other hand, such elements as video clips, news blogs, and chat rooms were excluded from the experimental site in order to reduce information volume differences between the two news versions. For the same reason news story search functions and links to other related stories were not included either.

To avoid major breaking news that could become salient to most participants, a relatively slow news day was selected. Moreover, to control for pre-exposure to *The Chosun Ilbo* and other news media, time delay to advance memory decay between the day of newspaper selection and the experimental day was built into the procedure. Six to three weeks before the experiment started, news content in weekday newspapers and websites was monitored on a regular basis. Three days that seemed to be slow news days were selected, based on the following criteria: no dominant breaking news (e.g., disasters, accidents, or major political events) and no repetition or redundancy in coverage of issues in the paper or on the website. Once each day was chosen, enough copies of that day's newspaper were purchased and the online news pages for that day (homepage, section pages, and recommendation) were downloaded. Through a careful comparison among the newspapers of the three days, the slowest news day (Thursday, April 17, 2008) was selected as the final experimental stimuli.

An experimental site was produced using the downloaded online news pages of the selected day. The downloaded homepage, section pages, and recommendation feature were used to build the online stimuli. Slight modification was necessary to make it more similar with the print version. For example, *The Chosun Ilbo* on the Web featured a link to the 10 “most viewed” stories overall, and for each section separately. This recommendation, however, included some news stories that appeared in the newspaper version one or two days before April 17, 2008. Two to five stories (depending on the news section) were excluded from the experimental site as well as the recommendation feature. In order to balance the number of “most viewed” stories across news sections, only the five top stories per section were included in the final experimental stimuli. All stories that appeared in the online version only (e.g., real-time breaking news), except for six stories in the “most viewed” recommendation section, were removed from the experimental site to match the print version. For the same reason six news articles placed in the print version only⁵ were added to the online version. As a result, there were a total 104 news stories in both media and the similarity of stories across conditions was over 94%. Of the one hundred and four articles, approximately two thirds (73 for the newspaper and 70 for the online news) were public affairs news and one third (31 and 34, respectively) were entertainment news (see “News content” section below for content categorization). Such proportional differences across public affairs and entertainment news stories were maintained primarily for the ecological validity of the study, albeit news exposure preferences, a main focus of this study, could be examined more precisely with the equal number of news stories across the two content areas. Indeed, the number of entertainment news stories seems to be sufficient for participants to spend the reading session (15 minutes) for entertainment news only, if they decided to do so. The order

⁵ In fact, these stories were not exclusive to the print version. They were in the archive of *The Chosun Ilbo on the Web* but their headlines did not appear on the downloaded homepage or the section pages of the selected day.

of online news headlines on the homepage and each section page of the experimental site was the same as the original site. As for the added stories in the online version, their headlines were placed in relevant topical section pages based on the time of uploading. Lastly, advertisements were downloaded and included in the experimental website.

News content. The print version of *The Chosun Ilbo* on weekdays consists of the sections: leading or breaking news, national, local, international, culture, sports, people, and opinion. Together these comprise “Section A,” which was used for the experiment.

“Business & technology” (Section B)⁶ and “Other” (Section D) are separate pull-out supplemental sections to the main section. These two independent sections were not used as experimental stimuli. The primary reason for excluding the “Business & technology” section is that the news stories covered in this section do not clearly deal with either public affairs or entertainment news. Important economic news, particularly related to politics or government policies, is presented in “Section A.” As for the “Other” section, topical coverage varies depending on the day of the week (e.g., health, weekend magazine, travel, books, food).

The “Opinion” portion of “Section A” was also excluded from the stimuli. The “Opinion” section includes editorials, columns, and opinions from readers, which deal with interpretations of socially important issues rather than news itself. Many of these opinions might be redundant with news stories of that day in terms of content. Furthermore, opinions—particularly editorials or columns—might influence reader understanding of important issues and

⁶ The “Business & technology” section includes news stories about business affairs, business people, technology, stocks (including a stock list), real estate etc. Interestingly, television programming schedules are also featured in this section.

affect the comprehension measure used in this study. Three pages of the “Opinion” section were stapled together in advance so that experimental participants were not exposed to them.

In “Section A,” leading or breaking news occupies the largest space—7 pages, excluding full-page advertisements. Most pages in this section were labeled “general news” but 2 of 7 pages were devoted to political news only and titled as such. This leading or breaking news offers information on the most important news stories of the day and the majority of the stories are about public affairs such as political, national, and international news. The selected day’s news stories covered in this section all dealt with public affairs, except the last page which featured news about “ireader” or the screen newspaper service of *The Chosun Ilbo*. These news stories were in the “Culture” section of the online version while all other stories of the leading or breaking news section in the print version were about politics, national, or international news. Thus, this last page of the leading or breaking news section was treated as “Culture” section, not leading or breaking news section in analysis.

The Chosun Ilbo on the Web offers several categorical tabs above the main title: my home, news, sports & entertainment, news plus, café/blogs, and morning plus. Of these tabs, only “News” and “Sports & entertainment”⁷ was incorporated as experimental stimuli. The “News” tab consisted of the following topical menus: latest news, business & technology, politics, national, international, culture, and editorials & columns. Of these menus, “Business & technology” and “Editorials & columns” were excluded from the experimental site, to match the print stimuli.

⁷ The “Sports & entertainment” tab includes several sub-categories such as sports, Korean athletes overseas, golf, show business, movies, and cartoons. All these categories except “sports” are exclusive to the Web-version of *The Chosun Ilbo*. Therefore, only the “sports” category was included in the experimental website.

Under the “Latest news” tab, news stories from all topical categories were ordered by the time of uploading. Therefore, this menu cannot be regarded as a category of either public affairs or entertainment news. However, all the news stories in this menu belong to corresponding topical menus (e.g., politics, culture) and are accessible through other paths (e.g., from the homepage, topical indexes, and recommendation) in addition to the latest news tab. The reason why the latest news menu was included as an index menu with topical categories is that it reflects an important structural feature of online news.

To summarize, the print version had the following sections: leading or breaking news (including politics), national, local, international, culture, sports, and people. The online version included the following menus: latest news, politics, national, international, culture, and sports. “Local” and “People” news in the online version were located under the “National” and “Culture” menus respectively. Of these sections/menus, politics, leading or breaking news (print version only), national, local, and international sections were regarded as public affairs news, and sports, culture, and people sections were treated as entertainment news.

Participants

Education. As is common in knowledge gap research, this study used education instead of SES (Socio-Economic Status) as an independent variable. In fact, SES is a multifaceted concept which includes several dimensions. Education, income, and occupation are the primary indicators of SES (sometimes alone as a single indicator, and other times together as a composite measure). However, education is most frequently used in knowledge gap research for several reasons. Compared to income and occupation, education is relatively easy to quantify so that no responses and ambiguous answers are kept to a minimum. Past empirical research has shown strong correlations between education and other SES variables (Gaziano, 1997).

For the study reported here, participants in the high education group had some postgraduate education and those in the low education group had no more than a high school education (see Grabe, et al., 2000). Information about participants and recruitment procedures are offered in the “Purposive recruitment” and “Procedure” sections below.

Geographical area of study. The experiment for this study was conducted at Seoul National University (SNU) in Korea. South Korea is one of the leading countries in Internet adoption rates, particularly the number of broadband Internet service subscribers. According to the official statistics of the ITU, or the International Telecommunication Union (2007), 71.11% of the population in South Korea were Internet users in 2006. This figure is significantly higher than the world average (57.16 %), with South Korea ranking sixth out of 211 countries around the world. A recent Korean data (June, 2007) shows that approximately 14.4 of 48.4 million Koreans (29.8%) subscribe to broadband Internet services (Ministry of Information and Communication in Korea, 2007). As of December 2006, South Korea ranked fourth out of 30 OECD (Organization for Economic Cooperation and Development) member nations in the number of broadband subscribers (OECD, 2007). This figure is just 3% lower than the first ranked country (Denmark) and well above the average (16.9%) for OECD members. The U.S. ranked fifteenth with 19.6% of broadband subscribers. Interestingly, 100% of Internet subscribers in Korea are broadband service subscribers—the world average is around 50% (International Telecommunication Union, 2007).

Even though Internet use has been growing rapidly, its distribution is still uneven within as well as across countries. To control for varying levels of Internet familiarity between low and high education participants, recruitment procedures were used to select only participants who have some experience with using the Internet. Given the high Internet penetration rate in South Korea, it was relatively easy to recruit Internet users for the low education group. A recent

survey (National Internet Development Agency of Korea, 2007) shows that a considerable portion (64.4%) of Internet users in Korea have accessed the Web for news consumption and most of them (94.8%) read online news at least once a week: 34.4% “more than once a day”, and 60.5% “more than once a week.” Even if Internet non-users are included, the majority (87.3%) of respondents with a college/university degree (including graduate students) and more than half (62.7%) of respondents with a high school degree or less have accessed online news outlets. More specifically, over 35% of college or university graduates read online news more than once a day, followed by 19% of high school graduates and 6% of middle school graduates. Moreover, 85% of college or university graduates, 65% of high school graduates, and 48% of middle school graduates read online news at least once a week. These proportions are significantly higher than in the U.S. According to a survey conducted by the Pew Research Center (2006), 22% of respondents who have some post-graduate education get news online on a daily basis, followed by 15% of college graduates and 9% of those who have some college education. On the other hand, only 6% of high school graduates read online news regularly, and 2% of middle school graduates do so.

Purposive recruitment. In order to decrease the possibility of confounding effects, participants were purposively chosen, as is often the case in experimental research (Babbie, 2001). Only those who have experience using the Web for news consumption were recruited. By doing so, the novelty of using unfamiliar media can be controlled. Selective sampling is particularly important considering that less educated people generally use online news less often than more educated people. It is notable, however, that different education groups also vary in terms of newspaper use. A recent survey research (Pew Research Center, 2006) shows that 52% of those who have at least some post graduate education read newspapers every day, followed by 43% of college graduates. On the other hand, about 36% of high school graduates and 27% of those who do not have a high school degree read newspaper on a daily basis. In Korea, 30% of

university/college graduates (including current undergraduates and graduate students) read newspapers every day, while approximately 21% of those who do not have college education do so (Korean Association of Newspapers, 2006b). These figures imply that high and low education groups are different not only in online news consumption but also in overall news media use. Therefore, online news use and newspaper readership were treated as covariates and controlled statistically (see “Media use variables as covariates” below).

Based on research findings that show strong inverse correlations between age and online news use, people over 60 years of age were not selected as participants. Those in their late teens and early 20s were also excluded because of the educational factor. Young adults are unlikely to have had the opportunity to complete high levels of education. Thus, participants in their mid 20s to late 50s were recruited for the experiment. According to a Pew Research Center study (2006), more than 30 % of respondents in this age group consume online news at least three days a week (42% of 25-29, 47% of 30-34, 37% of 35-49, and 31% of 50-64, respectively). This proportion is considerably higher than that of the older age group (11% of 65+). Korean data (National Internet Development Agency of Korea, 2007) also shows that people between 20 and 59 read online news more than older people. Specifically, 95% of respondents in their 20s use online news more than once a week, followed by 92% of the 30 to 39 year group, 75% of those in their 40s, and 45% of 50-59 years olds. As for those 60s or older, only 17% read online news at least once a week.

Dependent Variables

This study has three main dependent variables: disorientation, news exposure, and knowledge acquisition. News exposure and knowledge acquisition were assessed through multiple measures. Specifically, the behavior of participants was observed as the primary measure of news exposure and compared with self-report measures of exposure. Knowledge

acquisition was measured as free recall, comprehension, and recognition of story exposure. Several knowledge tests were employed because each of them is expected to reveal different aspects of memory. A couple of media use variables were also included in the posttest questionnaire. Because they are expected to affect the relationships between experimental factors and dependent variables, they were treated as covariates in statistical analysis.

Disorientation

A scale developed by Eveland, Marton, and Seo (2004) were used to measure disorientation. Because their study dealt with online news only, the index was modified to accommodate responses to newspaper exposure. Participants reported their feelings of disorientation by indicating the degree of agreement to each item as presented in Appendix A. The final disorientation index was constructed as the average of five Likert-type items with an acceptable reliability score (Cronbach's $\alpha = .68$).

News Exposure

Observation and self-report measures were employed to assess news exposure. Due to the technological differences between print and hypertext, the methods that were used to observe exposure to both media varied. For the newspaper condition, observers recorded the reading patterns of participants. With online news, it was technically possible to save the log files of page view chronologies and exposure time. The reason for employing these behavioral measures is to examine exposure in a more objective way, compared to self-report measures.

A number of researchers (e.g., Bechtel, et al., 1972; Papper, et al., 2004; Price & Zaller, 1993; Steiner, 1966; Tewksbury, 2003) have questioned the validity of self-reported media use. Yet, self-reports via telephone surveys and media diaries are standard instruments for measuring media use (Papper, et al., 2004). Efforts to develop more accurate ways to measure media use

started in mid 1960s. For example, Steiner (1966) examined viewing behavior of TV commercials by having college students observe one of their own family members. As Papper et al. (2004) pointed out, multiple measures of media use in the same study and comparisons among them are rare. Yet, it has been shown that media users generally underestimate their media use. Specifically, in a telephone survey participants reported that they spent about half the time with media that they did, according to the observational measure (Papper, et al., 2004).

Behavioral measure. For the newspaper condition, trained observers recorded the chronology and exact time participants spent on each page of the newspaper on log sheets (see Appendix B). Specifically, they filled the exact starting time (minute and second) and the page number whenever participants turned a page of the newspaper. Page numbers were marked, in advance, on the upper right or left corner of each page so that coders were able to see them from a distance. If participants explored the newspaper, which means they stayed with a certain page less than 3 seconds or kept turning pages, it was recorded as “exploration” and regarded as such. For the online news condition, saving log files of page view chronologies and exposure time spent with each page was programmed when the experimental website was produced.

While the observation method for the newspaper condition provided participant exposure time to “each newspaper page,” log files for the online news condition offered the exact exposure time to each “news story.” This creates considerable differences in calculating exposure time for the two news media. The log files recorded news story exposure without accounting for exposure to advertisements or their exploration of the homepage or section pages in selecting news stories to read. On the other hand, in the newspaper condition each participant’s exposure to full-page advertisements and exploration between pages were observed and recorded. It was technically impossible, however, to identify how much time they spent with ads placed with news articles on the same page. The newspaper stimuli consisted of 32 pages including 9 full-page ads, and every

page (except one) featured at least one advertisement. Considering that about two thirds of participants in the newspaper condition spent some time reading full-page ads ($M = 38.2$ seconds, $SD = 29.2$), many newspaper readers might also have spent time reading smaller in-page ads.

To make matters worse, observed time for each newspaper page might also be confounded with the time participants spent exploring news stories within a page. Although a newspaper reader might not have spent even one second reading advertisements, there is no certainty that he or she spent the entire time reading news stories. Unless the hypothetical participant read all the news stories on a given page (which means there was no selective exposure for that page) some of the observed exposure time might have been used choosing which stories to read. As stated above, online news users' exploration on the homepage or section pages was neither recorded nor regarded as news exposure.

In short, recorded time for news reading in the newspaper group might be confounded with time for news story selection and advertisement exposure. In fact, the calculated news exposure time was significantly longer among the newspaper reader group ($M = 851.1$ seconds, $SD = 72.1$) than the online news user group ($M = 686.9$, $SD = 144.3$), $t(90.03) = 8.00$, $p = .001$. It seems very unlikely that this difference could be attributed to the medium only. A more plausible explanation is the variation in exposure measures across the two media.

Based on these considerations, proportions of exposure time to public affairs and entertainment news stories were calculated and used for hypotheses testing. First, the total exposure time to all public affairs and entertainment news stories (for online news) or pages (for newspaper) was summed. Second, exposure time to each content category (public affairs and entertainment news) was calculated as a percentage of overall exposure time. These two percentages were used in statistical analysis. This procedure has an additional strength, compared

to time duration measures. Because self-report measure of exposure was limited to news story exposure (excluding exploration and advertisement exposure) and measured by percentage instead of time (see below), it is pertinent to compare directly behavioral and self-report measures of news exposure.

Self report. Participants were asked to report the percentages of time they spent (during the reading session) with news stories by topical categories: politics, international, national/regional, culture/people, and sports (see Tewksbury & Althaus, 2000, and Appendix C). Topical news categories instead of sections of the newspaper or menus of the online news site were focused on for several reasons. First, the leading or breaking news section of the newspaper and the latest news menu of the online version were likely to feature various news story topics. Thus, asking participants how much time they spent with a specific section or menu might not provide accurate accounts of story topic exposure, which is central to this study. Second, it seems likely that news consumers are more aware of the content categories than the particular sections or menus they exposed themselves to in that online news readers can jump from section to section by simply clicking on indexed menus. Third, hypertext makes it possible for users to access a news story from innumerable paths (e.g., from the homepage, from topical indexes, from latest news lists, from recommendation feature, from related news stories) (Thorson, 2008). Due to these features, online news readers are less likely to be aware of which sections or menus they exposed themselves to. Yet, it seems reasonable to expect that news readers, regardless of the medium they are exposed to, can provide an estimate of the percentage of time they spent with news stories in topical areas.

For the purpose of comparison with behavioral measure scores, exposure responses to topical categories were aggregated for public affairs news (politics, international, and national/regional) and entertainment news (culture/people, and sports).

Knowledge Acquisition

Among the ways of quantifying knowledge gain, free recall, cued recall, recognition, and comprehension are the most frequently used measures of memory (Tremayne & Dunwoody, 2001). Many scholars have argued that different memory measures can index different dimensions or sub-processes of information processing (Craik & Lockhart, 1972; Lang, 2000; Shoemaker, Schooler, & Danielson, 1989; Tulving & Thompson, 1973). According to Lang (2000), recognition is a measure of the encoding process, cued recall gives insight into storage, and free recall reveals retrieval processes.

Recognition measures typically present multiple cues to respondents and they are asked to select the one that matches the experimental stimuli. With cued recall tests a single cue is offered to trigger memory and typically participants are asked to record what they remember about stimuli based on the single cue. In free recall tests respondents are not provided with cues to activate memory—they are asked to report anything they remember about stimuli (Lang, 2000). Comprehension involves more than memory for discrete information; tests are designed to assess if participants integrated information into a meaningful system of existing knowledge (Tremayne & Dunwoody, 2001). Studies on how people learn from news have made conceptual distinctions between understanding and remembering news content (Ortony, 1978; Robinson & Levy, 1986; Snoeijer, et al., 2002; Woodall, et al., 1983). This study employed multiple memory measures: free recall, comprehension, and recognition of story exposure.

Free recall. This is a useful measure to assess learning from different media comparatively because it is not a content-dependent test. In other words, free recall does not require the same exposure among participants (Eveland, et al., 2002). This study investigates differences among participants in news selection and accordingly different knowledge acquisition. Participants might select news stories of their own choice in the relatively wide

scope of the whole newspaper or website, rather than be asked to read a certain number of news stories as done in most experimental research projects on learning from media. Cued recall measures would be inappropriate for the present study because it might confound knowledge gain with exposure. For example, some participants might have a zero score for certain items on a cued recall test not because they did not acquire knowledge from reading the story, but because they did not read the news story.

Thus, participants were asked to recall freely what they remember from exposure to the experimental stimuli. Specifically, they were asked to briefly describe all the news stories they remember: They described each news story using 5 to 10 words and numbered each story (see Appendix D). Responses were scored for accuracy with a complete list of news articles from the print and online versions of stimuli. Specifically, each participant response (description of a news story) was compared with the content of a relevant news article to examine the correspondence. Each answer was classified as correct, incorrect, or off-topic (see Tewksbury & Althaus, 2000) based on the agreement between the participant's description and news story content. Responses which included accurate information were categorized as correct free recall, even though they did not seem to reflect a gist of a given news story. At first, a primary coder and a second coder examined the same 10% of responses, to test the inter-rater reliability. Since the reliability of the two coders' categorization was fairly high (Cohen's Kappa = .91), the primary coder analyzed the remaining responses. Correct free recall scores were computed for each subject on public affairs and entertainment news respectively.

A number of participants (46 of 123) failed to recall any entertainment stories while every participant successfully recalled at least one public affairs news story. For those who did not recall any entertainment news, free recall scores were determined depending on behavioral measures of news exposure (see details above). Ten participants did not spend any time with

entertainment news according to the observational news exposure measure. For these ten participants free recall scores for entertainment news were marked as missing. On the other hand, for other 36 participants who spent time with entertainment news stories, a zero score was entered into the data set.

Comprehension. Where free recall assesses which news stories are remembered, the comprehension test assesses how well participants understand news stories that they chose to read. According to Robinson and Levy (1986), comprehension refers to the ability to understand the central points of news stories. In essence the comprehension measure reveals if participants grasped the main point of a news story rather than if they recall the news story or details from it. In other words, being able to remember factual details (e.g., geographical locations, people's names) is neither a necessary nor a sufficient condition for comprehension. Robinson and Levy suggest that an additional benefit of using comprehension measures is the partial control for the effects of news exposure from other media sources. Even though respondents might know something about a particular news story, comprehension measures assess if they acquired the information from experimental stimuli, by asking them what the main point of the story was.

For the comprehension test, participants were asked to describe in detail what they remembered about the news stories they listed in the free recall measure (see Appendix E). Participant responses were analyzed and scored following the coding scheme devised by Robinson and Levy (1986, see Figure 3-2) and using the central point identified by three professional journalists (see Robinson & Levy, 1986). They are employed at different national daily newspapers in Korea, reporting on different topics including politics, foreign affairs, and culture. Their working experience as journalists ranged from six to ten years. The journalists

independently assessed the main points and their responses showed complete agreement on the main point of each story (Cohen's Kappa = 1).

Figure 3-2. Basic Coding Scheme (Robinson & Levy, 1986, p. 111)

Score	Type of Responses
0	Recall wrong story, information not in the newscast
1	Cannot recall; no reply; don't know
2	Recall something but then can give no details
3	Vague, general responses related to the story
4	Some details of the story, but not the central point
Comprehension Threshold	
5	Central point of the story, no further important details
6	Central point of the story, plus one further important detail
7	Central point of the story, plus two further important details
8	Central point of the story, plus three or more further important details

Two coders were trained to analyze the comprehension responses. As was done with the free recall measure, a second coder examined 10% of randomly selected comprehension responses and this data was compared with the primary coder's, to examine the agreement between the two raters. The inter-coder reliability was acceptable (Cohen's Kappa = .63). The averages of participant scores ranged from 0 to 8 on public affairs and entertainment news stories were the final comprehension knowledge scores for public affairs and entertainment content.⁸

⁸ Even though the score range for comprehension is zero to eight, no comprehension response achieved zero (*recall wrong story*) or one (*cannot recall*) category. In this study news story items of the comprehension measure were dependent on the free recall measure, and accordingly, participant comprehension was measured only for news stories that participants recalled.

Ten participants did not expose themselves to any entertainment news stories. Their comprehension score for entertainment news was treated as missing instead of zero, as was done for the free recall measure.

In this study the mean, instead of the sum of item scores, was used as the final comprehension score (see Robinson & Levy, 1986). The reason for this is that the items (including the number of items) of the comprehension measure were contingent on the free recall measure and accordingly varied within as well as across conditions. In most studies on learning from the media, items for the comprehension measure are identical for all participants because participants are exposed to the same news stories. Yet, participants in this study selected news stories of their own choice and accordingly recalled different numbers of stories. Considering that the essence of comprehension measure is to test understanding of the central point, a different number of comprehension items across participants might confound comprehension with other factors.

Recognition of story exposure. Generally, recognition of stories is tested by employing closed-ended questions (Tremayne & Dunwoody, 2001). Recognition tests are fully dependent on the content of experimental stimuli. A recognition measure is therefore inappropriate for this study considering that story exposure is expected to differ within an experimental condition as well as across conditions. An alternative technique for measuring story recognition was devised, to make the recognition measure less content-dependent.

After the comprehension measure, participants were given an exhaustive list of story headlines and asked to check on the headlines of news stores which they had read with a marking pen. The headlines of the newspaper condition were ordered linearly from the front page to the last page. As for the online news, the headlines were listed by topical section: from the homepage to the sports menu. Among the marked news articles, public affairs and entertainment

stories were counted and the sum of checked stories in each content area produced the final score for the recognition test. Different from the free recall measure, it was virtually impossible to assess whether reported recognition of each news story was correct or false, particularly among participants in the print condition. The data derived from the observation method employed for the newspaper condition assessed participant exposure (time and order) to newspaper pages, instead of news stories. In contrast, the log files for the online news condition offered exact exposure time and order based on news story. Considering these differences between the two media conditions, false recognition for the online news group was not excluded from the final recognition score, to equalize the two media conditions. In other words, reported recognition of story exposure, not correct recognition, constituted the final recognition score.

Media Use Variables as Covariates

Several media use variables have been shown to affect the relationships between experimental factors and dependent variables. Thus, they were measured to be used as covariates for statistical control.

Media use. Weekly Internet use, online news use, and newspaper use were assessed with two sequential questions. First, participants were asked to estimate the frequency of media use with 6 choices (*nearly everyday, 3 to 5 days per week, 1 or 2 days per week, once every few weeks, less often, and never*). In the subsequent question, they reported the approximate time spent on a day they use a given medium (see Appendix F). To construct a weekly media use measure, responses to the first closed-ended question were recoded into a scale of weekly days of media use (7, 4, 1.5, 0.25, 0.05, and 0) and multiplied by the responses to the second open-ended question. Althaus and Tewksbury (2000) used a similar technique to assess the time spent with various media. Questionnaire wording and response options were modeled after Althaus and Tewksbury's study and the Pew Research Center's studies (2004, 2006).

Pre-exposure to experimental stimuli. Different from other media use covariates above, pre-exposure to experimental stimuli was assessed by the frequency of use only. Time spent using a particular newspaper or a news website is more difficult to estimate than overall media use and accordingly likely to be vulnerable to measurement error. For the pre-exposure measure, participants were asked to estimate the frequency of their use of *The Chosun Ilbo* and its website, using the same six choices with the preceding media use measures (see Appendix F, see also Althaus & Tewksbury, 2000; Pew Research Center, 2004, 2006, for question wording).

Procedure

Recruitment

An advertisement was posted on bulletin boards throughout Seoul National University and disseminated through the campus mailing list to recruit volunteer participants. This advertisement was targeted at graduate students for the high education group. For the low education group, the advertisement was placed in free newspapers⁹ distributed in the neighborhood of the SNU. Participants for the low education group were also recruited from computer-related classes sponsored by local government offices.

The recruiting statement of the advertisement featured a bold heading: “An invitation to participate in a news study.” The text read as follows: “It will take about an hour of your time and we will pay 20 thousand won (approximately \$20) to each participant. If you are between 24 and 59 years old, please email us at XXXXXXXX or call us at XXXXXXXX to schedule your participation.”

⁹ These free newspapers mainly feature help-wanted ads or secondhand goods for sale. Because Seoul is a large city, editions of these papers are different depending on the district in which they are distributed.

When potential participants responded to the advertisements, their age, gender, education, newspaper use, and online news experience were examined using a short questionnaire to assess whether they fit the parameters of this study (see Appendix G, see also Pew Research Center, 2004, 2006, for question wording). To recruit participants with different educational backgrounds, people having some postgraduate education and those with no more than a high school degree were scheduled for data collection. Moreover, participants in their mid 20s to late 50s were selected because this age group use online news considerably more than other age groups (National Internet Development Agency of Korea, 2007; Pew Research Center, 2006). News media use (newspaper and online news) were examined to recruit only those who use these media at least occasionally. The primary reason for this purposive recruitment based on age and media use is to control for the novelty of different news media use.

Volunteers who fit the parameters were scheduled for participation and asked to provide their contact information. Those who did not fit the parameters of the study were thanked and told that they unfortunately did not fit the parameters of what was needed for the study. Participants received reminders via email and cell phone text messaging one or two days before their scheduled participation in the experiment.

One hundred twenty three volunteers who satisfied the parameters participated in the experiment. Among them, seventy four participants composed the high education group: Seventy one were graduate students and three people completed graduate degrees. Of forty-nine participants in the low education group, thirty-eight had a high school degree and eleven participants had no more than a middle school education. In addition, approximately two thirds of the low education group were recruited from computer classes; the other third from the posted advertisements. The age of participants ranged from mid 20s to 50s. Yet, age variance between the two education groups was large, $t(51.76) = 11.77, p = .001$. The high education group was

younger ($M = 26.28$, $SD = 2.88$) than the low education group ($M = 46.76$, $SD = 11.95$).

Therefore, age was statistically controlled as a covariate together with five media use variables in testing hypotheses. Overall, there were 50 men and 73 women participants in this study. For the high education group, 32 participants were male and 42 were female. For the low education group, 18 men and 31 women participated. In order to achieve gender balance across different experimental conditions, equal (or nearly equal) numbers of men and women from each education group were assigned to the two media groups. Table 3-1 shows participant composition by education, presentation mode, and gender.

Table 3-1

Participants by Education, Presentation Mode, and Gender

Group	Presentation Mode		Total (%)
	Print (%)	Online (%)	
High			
Male	17 (27.8%)	15 (24.2%)	32 (26.0%)
Female	20 (32.8%)	22 (35.5%)	42 (34.2%)
Low			
Male	9 (14.8%)	9 (14.5%)	18 (14.6%)
Female	15 (24.6%)	16 (25.8%)	31 (25.2%)
Total	61 (100%)	62 (100%)	123 (100%)

Experiment

The experiment for this study was conducted at a computer laboratory of SNU during 4 consecutive weekdays. Upon arrival at the experimental location, participants for each education group were randomly assigned to either the print or the online news condition, keeping the

groups gender balanced. Participants in the online news group were seated at personal computers, and those in the newspaper group were seated in comfortable chairs. After signing the informed consent form, participants were offered a brief explanation of the experimental procedure and questions were answered by the experimenter.

Participants in the newspaper group were instructed to read the print version of *The Chosun Ilbo* for 15 minutes and those in the online news group were asked to browse the experimental website of *The Chosun Ilbo* for the same amount of time. Both groups were asked to use the experimental stimuli as they usually do in their daily lives. Fifteen minutes duration of the reading session was decided based on several considerations. According to recent survey data, the average time spent on newspaper reading per day is approximately 30 minutes (Korean Association of Newspapers, 2006a, 2006b; Pew Research Center, 2006). This average time is, however, derived from newspaper readers only, which means those who do not read newspapers regularly are excluded. Furthermore, the experimental stimuli for this study has a much smaller number of pages and therefore less informational volume than newspapers typically have. In fact, the “Opinion” section and separate pull-out supplemental sections were excluded from the experimental stimuli. Limiting the reading session to 15 minutes also encouraged selective exposure among participants, which is an important element for this study.

After the reading/browsing session, participants completed posttest questionnaires. First, participants were asked to fill out the disorientation and self-assessment of news exposure questionnaires. Then, free recall and comprehension were measured. Following the two knowledge acquisition tests, participants were given the list of news story headlines and asked to check the news articles that they recognized reading with a marking pen. Finally, self-report media use items were administered (Internet use/online news use/newspaper use, pre-exposure to the experimental stimuli). Participants were thanked, debriefed, and paid for their participation.

CHAPTER 4

Results

Analysis Overview

To test the hypotheses, an Education (2) x Presentation Mode (2) ANOVA and an ANCOVA with covariates were conducted for each dependent variable. In addition, proportional differences (i.e., percent difference) between public affairs news exposure and entertainment news exposure were analyzed using one-way ANOVA and ANCOVA procedures with the Education (2) factor (see Hypothesis 2a).¹⁰ Moreover, knowledge acquisition data were subjected to an Education (2) x News Content (2) repeated measure ANOVA and an ANCOVA respectively (see Hypothesis 2b). Finally, entertainment news exposure and entertainment knowledge acquisition data were analyzed using one-way ANOVA and an ANCOVA tests with Presentation Mode (2) for the low education group (see Hypothesis 4a and 4b).

Hypothesis 1: Main effect for Education on Knowledge Acquisition

Hypothesis 1 predicted that the high education group would acquire more knowledge than the low education group from news media use across all three knowledge acquisition measures (free recall, comprehension, and recognition of exposure).

Free Recall

¹⁰ In principle, a repeated measure ANOVA and an ANCOVA should be conducted to test hypothesis 2a because it predicts an interaction effect of one between-subjects factor (audience education) and one within-subjects factor (news content) just like hypothesis 2b. However, the dependent variables of hypothesis 2a (public affairs and entertainment news exposure) are proportion scales. That is, every participant's scores for public affairs and entertainment news exposure always add up to 100% and each of the two scales has a complete inverse correlation with the other. Thus, it was meaningless to test the hypothesis with repeated measure analyses. It was possible, however, to test for proportional differences by creating a new variable that is the outcome of subtracting the original entertainment news exposure scaled score from the public affairs scaled score.

As predicted, participants in the high education group ($M = 9.64$, $SD = 3.89$) achieved a significantly higher score for free recall than their counterparts in the low education group ($M = 5.00$, $SD = 2.00$), $F(1, 121) = 59.17$, $p = .001$, partial $\eta^2 = .33$ (see Table 4-1). After adding covariates¹¹, the main effect for audience education on free recall remained significant, $F(1, 115) = 12.03$, $p = .001$, partial $\eta^2 = .10$, as presented in Table 4-1. That is, estimated marginal means for free recall was significantly higher among more educated participants ($M = 9.26$, $SE = .52$) than less educated participants ($M = 5.57$, $SE = .71$). None of the six covariates was significantly associated with the free recall data (see Table 4-1).

Table 4-1

Analysis of Variance and Covariance for Education on Free Recall of Overall News Stories

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education	1	59.17**	.33	.00
Error	121	(10.70)		
Age	1	1.71	.02	.19
Weekly newspaper use	1	2.02	.02	.16
Weekly Web use	1	.01	.00	.91
Weekly online news use	1	.13	.00	.72
Pre-exposure to print stimuli	1	.00	.00	.98
Pre-exposure to online stimuli	1	.19	.00	.66
Education	1	12.03**	.10	.00
Error	115	(10.69)		

Note. Values in parentheses represent mean square errors.

** $p < .01$

Comprehension

¹¹ Participant age, weekly newspaper use, weekly Web use, weekly online news use, pre-exposure to print stimuli, and pre-exposure to online stimuli

Consistent with the results of free recall and the prediction of hypothesis 1, a significant main effect was found for education on participant comprehension of news stories, $F(1, 121) = 72.92, p = .001$, partial $\eta^2 = .37$ (see Table 4-2). Indeed, the comprehension scores for the more educated group ($M = 5.65, SD = .74$) were higher than for the less educated group ($M = 4.09, SD = 1.33$). Yet, after controlling for the influence of covariates, the comprehension score difference between the high ($M = 5.65, SD = .74$) and low education group ($M = 4.09, SD = 1.33$) only approached statistical significance, $F(1, 115) = 2.96, p = .09$, partial $\eta^2 = .03$. It is noteworthy that the direction of means matched the prediction. As shown in Table 4-2, participant age was the only covariate significantly associated with the comprehension score, $F(1, 115) = 22.98, p = .001$, partial $\eta^2 = .17$. A partial correlation test showed that younger participants achieved a higher comprehension score than older counterparts, $pr = -.41, p = .001$.

Table 4-2

Analysis of Variance and Covariance for Education on Comprehension of Overall News Stories

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education	1	71.92 ^{**}	.37	.00
Error	121	(1.03)		
Age	1	22.98 ^{**}	.17	.00
Weekly newspaper use	1	.67	.01	.42
Weekly Web use	1	1.05	.01	.31
Weekly online news use	1	.06	.00	.80
Pre-exposure to print stimuli	1	2.02	.02	.16
Pre-exposure to online stimuli	1	.41	.00	.52
Education	1	2.96 [†]	.03	.09
Error	115	(.89)		

Note. Values in parentheses represent mean square errors.

[†] $p < .10$, ^{**} $p < .01$

Recognition of Story Exposure

Hypothesis 1 predicted that participants in the high education group would recognize more news stories that they had read during the experiment than those in the low education group. Unlike the results of the two other knowledge acquisition measures, participant recognition of story exposure did not vary across high ($M = 20.99, SD = 10.32$) and low ($M = 17.67, SD = 11.66$) education groups, $F(1, 121) = 2.72, p = .10$, partial $\eta^2 = .02$ (see Table 4-3). It is noteworthy that the means were in the predicted direction. The main effect for audience education on recognition of story exposure remained non-significant, $F(1, 115) = .73, p = .39$, partial $\eta^2 = .01$, after adding the covariates to the model. Yet, the means were in the predicted direction: Those in the high education group ($M = 20.87, SE = 1.72$) recognized more news stories than those in the low education group ($M = 17.85, SE = 2.33$).

Table 4-3

Analysis of Variance and Covariance for Education on Recognition of Overall News Stories

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education	1	2.72	.02	.10
Error	121	(118.28)		
Age	1	.07	.00	.79
Weekly newspaper use	1	.78	.01	.39
Weekly Web use	1	5.23*	.04	.02
Weekly online news use	1	3.34 [†]	.03	.07
Pre-exposure to print stimuli	1	.04	.00	.85
Pre-exposure to online stimuli	1	.00	.00	.98
Education	1	.73	.01	.39
Error	115	(117.08)		

Note. Values in parentheses represent mean square errors.

[†] $p < .10$, * $p < .05$

Of the six covariates, participant weekly Web use was significantly associated with news story recognition, $F(1, 115) = 5.23, p = .02$, partial $\eta^2 = .04$. Weekly online news use was almost significantly related, $F(1, 115) = 3.34, p = .07$, partial $\eta^2 = .03$, as displayed in Table 4-3. Partial correlation tests revealed that the more participants used the Web in general, the smaller the number of recognized news stories, $pr = -.21, p = .02$, while Web use particular to news information was positively correlated to news story recognition, $pr = .17, p = .70$.

In sum, the main effect for audience education on knowledge acquisition was not consistent across free recall, comprehension, and recognition measures. As predicted for free recall and comprehension, more educated participants performed better than less educated participants. Yet, recognition scores for the high education group were not statistically higher than the low education group's. Therefore, hypothesis 1 was partially supported—for free recall and comprehension only.

Hypothesis 2a: Interaction Effect for Education and News Content on News Exposure

Hypothesis 2a predicted an interaction effect such that less educated people would spend more time reading entertainment news than public affairs news and their exposure to public affairs news would be shorter than the higher education group's. The interaction effect for audience education and news content on news exposure was not significant, $F(1, 121) = 1.76, p = .19$, partial $\eta^2 = .01$. Thus, the proportional difference between public affairs news exposure and entertainment news exposure was not different across high ($M = 52.34, SD = 29.44$)¹² and low ($M = 60.12, SD = 35.18$)¹³ education groups. Contrary to the prediction, those in the low

¹² This mean corresponds to the average of the proportional difference between public affairs ($M = 76.17, SD = 14.72$) and entertainment ($M = 23.83, SD = 14.72$) news exposure for the high education group.

¹³ This mean refers to the average of the proportional difference between public affairs ($M = 80.06, SD = 17.59$) and entertainment ($M = 19.94, SD = 17.59$) news exposure for the low education group.

education group spent a smaller proportion of time reading entertainment news ($M = 19.94$, $SD = 17.59$) than public affairs news ($M = 80.06$, $SD = 17.59$) (see Table 4-4 and Figure 4-1).

Furthermore, the low education group spent as much time reading public affairs news as those in the high education group ($M = 76.17$, $SD = 14.72$), $F(1, 119) = 2.09$, $p = .15$, partial $\eta^2 = .02$.

Even after controlling for the six covariates, the interaction effect for education and news content on exposure time remained not significant, $F(1, 115) = .05$, $p = .82$, partial $\eta^2 = .00$. This confirms that the proportional difference (calculated as public affairs minus entertainment news exposure) was not different across high ($M = 56.37$, $SE = 4.92$)¹⁴ and low ($M = 54.04$, $SE = 6.72$)¹⁵ education groups. Similar to the results of the ANOVA test, participants in the low education group spent more time reading public affairs news ($M = 78.29$, $SE = 3.22$) than entertainment news ($M = 21.71$, $SE = 3.22$) (see Table 4-4 and Figure 4-1). At the same time, the high education group ($M = 77.40$, $SE = 2.35$) did not spend more time reading public affairs news than the low education group, $F(1, 113) = .03$, $p = .86$, $\eta^2 = .00$. In conclusion, the results do not support hypothesis 2a: The low education group did not spend more time with entertainment news than public affairs news and their exposure to public affairs news was not different from the high education group's.

¹⁴ This mean represents the average of the proportional difference between public affairs ($M = 77.40$, $SE = 2.35$) and entertainment ($M = 22.60$, $SE = 2.35$) news exposure for the high education group.

¹⁵ This mean stands for the average of the proportional difference between public affairs ($M = 78.29$, $SE = 3.22$) and entertainment ($M = 21.71$, $SE = 3.22$) news exposure for the low education group.

Table 4-4

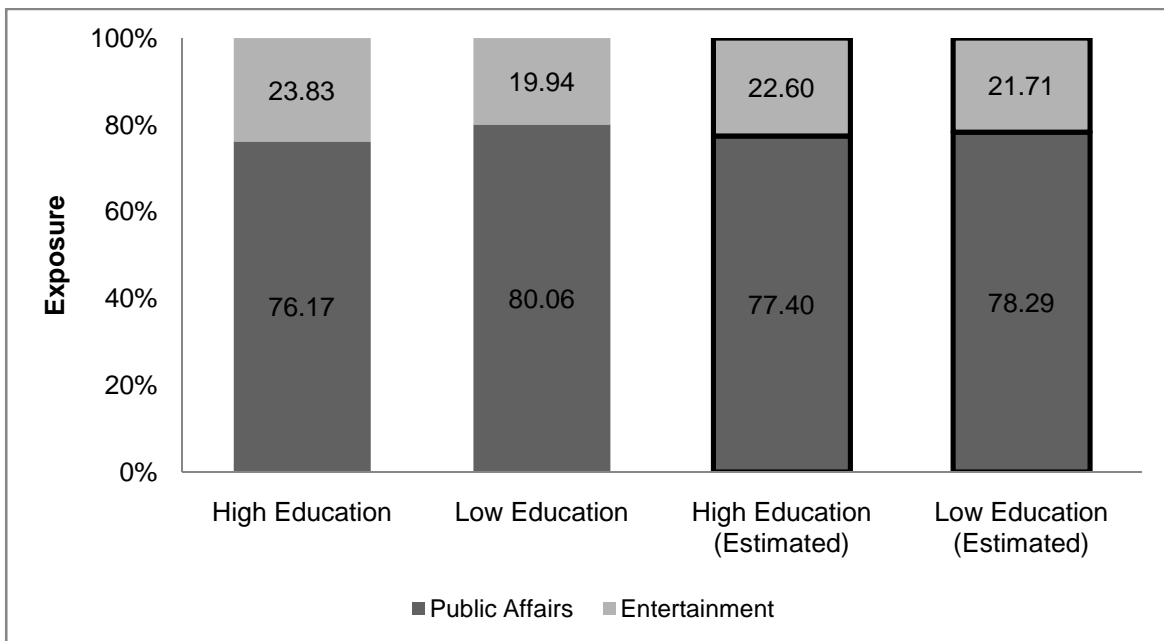
Observed Means and Estimated Means for Exposure Proportion by Education and News Content

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Public affairs	76.17	14.72	77.40 ^a	2.35
Entertainment	23.83	14.72	22.60 ^a	2.35
Low education				
Public affairs	80.06	17.59	78.29 ^a	3.22
Entertainment	19.94	17.59	21.71 ^a	3.22

Note. Exposure proportion represents the percentage that exposure time for each content area occupies in the total news exposure time. Thus, the sum of the two proportions for each education group is 100%.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.44, Weekly newspaper use = 163.97, Weekly Web use = 908.88, Weekly online news use = 241.42, Pre-exposure to print stimuli = 1.89, and Pre-exposure to online stimuli = .49.

Figure 4-1. Observed Means and Estimated Means for Exposure Proportion by Education and News Content



Hypothesis 2b: Interaction Effect for Education and News Content on Knowledge Acquisition

Hypothesis 2b predicted that less educated people would acquire more entertainment than public affairs knowledge from news media use, and that they would acquire less public affairs knowledge compared to the higher education group.

Free Recall

The interaction effect for audience education and news content was significant on free recall. Specifically, the results of the within-subjects effect showed a significant interaction between education and news content, $F(1, 109) = 11.12, p = .001, \eta^2 = .09$. At the same time, scores for average free recall across public affairs and entertainment news was significantly higher among more educated ($M = 4.87, SD = .19$) than less educated participants ($M = 2.51, SD = .24$), $F(1, 109) = 58.36, p = .001, \eta^2 = .35$. Participants in the low education group, however, recalled more public affairs ($M = 4.05, SD = 1.70$) than entertainment ($M = .98, SD = 1.12.43$) news stories, which was contrary to the predicted direction (see Table 4-5 and Figure 4-2). A paired t-test confirmed that this difference was statistically significant, $t(41) = 9.09, p = .001$. At the same time, the high education group ($M = 7.33, SD = 2.75$) significantly outscored the low education group on free recall of public affairs news, in line with hypothesis 2b, $t(118.18) = 8.12, p = .001$.

After adding covariates to the model, average free recall across public affairs and entertainment news was still significantly higher for the more educated ($M = 4.75, SE = .26$) than less educated group ($M = 2.71, SE = .38$), $F(1, 103) = 12.98, p = .001, \eta^2 = .11$. In addition, the low education group recalled more public affairs ($M = 3.87, SE = .59$) than entertainment news ($M = 1.55, SE = .43$), after adjusting for the effects of covariates (see Table 4-5 and Figure 4-

2).¹⁶ Thus, the two group means remained opposite to the prediction. Free recall of public affairs news, however, was in line with what was predicted in hypothesis 2b. More educated participants ($M = 7.44$, $SE = .40$) achieved higher scores than less educated participants. Results from a one-way ANCOVA showed that this difference was statistically significant, $F(1, 113) = 19.14$, $p = .001$, $\eta^2 = .15$.

Table 4-5

Observed Means and Estimated Means for Free Recall by Education and News Content

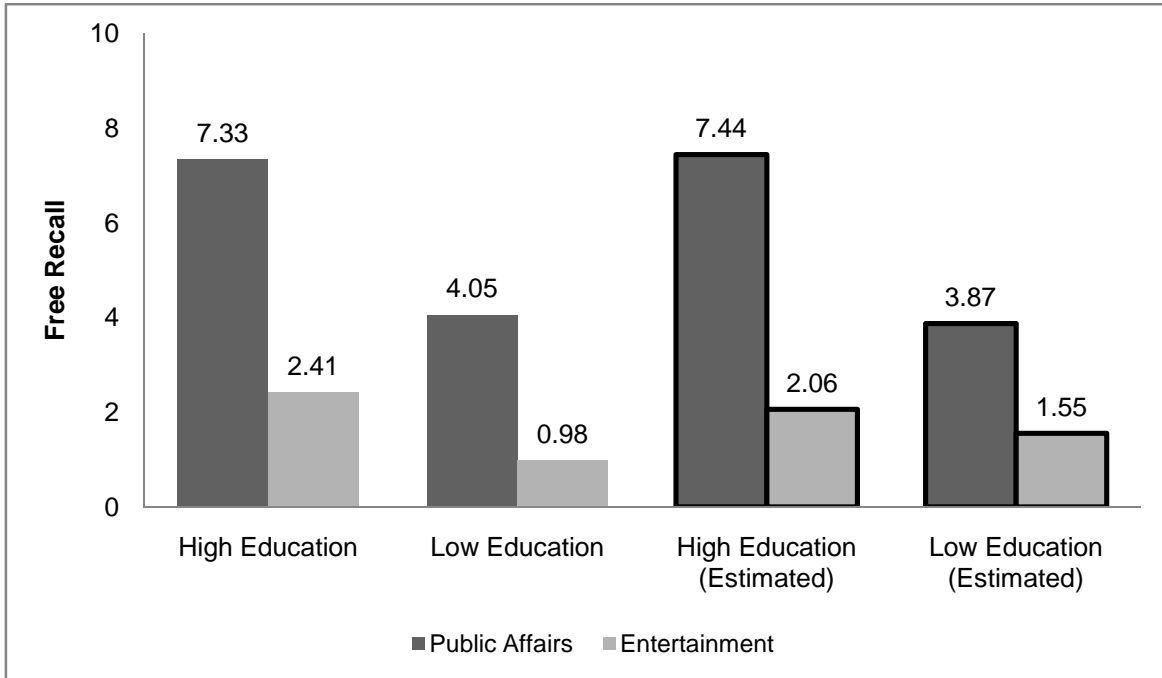
Group	Observed Mean	SD	Estimated Mean	SE
High education				
Public affairs	7.33	2.75	7.44 ^a	.40
Entertainment	2.41	2.10	2.06 ^a	.29
Low education				
Public affairs	4.05	1.70	3.87 ^a	.59
Entertainment	.98	1.12	1.55 ^a	.43

Note. Free recall scores represent the number of news stories which participants correctly recalled from news reading.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.89, Weekly newspaper use = 146.67, Weekly Web use = 880.11, Weekly online news use = 236.39, Pre-exposure to print stimuli = 1.81, and Pre-exposure to online stimuli = .41.

¹⁶ To test a repeated measures ANCOVA with a between-subject factor, this study employed a two model approach devised by Winer, Brown, and Michels (1991). According to this approach, two GLMs (General Linear Models) should be run: a model with the covariates and a model without the covariates. For the former, however, the results of between-subjects portion only are supposed to be reported. To do so, it is possible to exclude interactions between a within-subjects factor and covariates from the model to be analyzed.

Figure 4-2. Observed Means and Estimated Means for Free Recall by Education and News Content



Comprehension

Unlike the results of free recall, the within-subjects portion of the results showed the interaction effect for audience education and news content was not significant on comprehension of news stories, $F(1, 111) = 2.06, p = .15, \eta^2 = .02$. Yet, the between-subjects portion showed the average of public affairs and entertainment news comprehension scores was statistically different between the high ($M = 5.04, SD = .17$) and low education group ($M = 3.11, SD = .22$), $F(1, 105) = 46.62, p = .001, \eta^2 = .30$. Contrary to the predicted direction, participants in the low education group showed better comprehension of public affairs news ($M = 4.10, SD = 1.42$) than entertainment news ($M = 2.13, SD = 2.31$) (see Table 4-6 and Figure 4-3). A paired t -test confirmed that this difference was statistically significant, $t(42) = 5.52, p = .001$. As predicted, the high education group ($M = 5.68, SD = .80$) achieved better comprehension scores than the low education group for public affairs news, $t(68.58) = 7.15, p = .001$.

Including covariates into the model turned the significant between-subjects effect into a non-significant finding, $F(1, 105) = .98, p = .32, \eta^2 = .01$. That is, the average comprehension across public affairs and entertainment news was not statistically different between the high ($M = 4.48, SE = .22$) and low education group ($M = 4.02, SE = .32$), despite the predicted direction of the group means. Furthermore, estimated marginal means for public affairs news comprehension ($M = 4.69, SE = .23$) was higher than for entertainment news comprehension ($M = 3.35, SE = .55$) among less educated participants, contrary to the prediction (see Table 4-6 and Figure 4-3). On the other hand, for the comprehension of public affairs news, the means were in line with the predicted direction: More educated participants ($M = 5.32, SE = .16$) attained higher scores than the less educated, $F(1, 115) = 2.92, p = .09, \eta^2 = .03$ from a one-way ANCOVA with Education.

Table 4-6

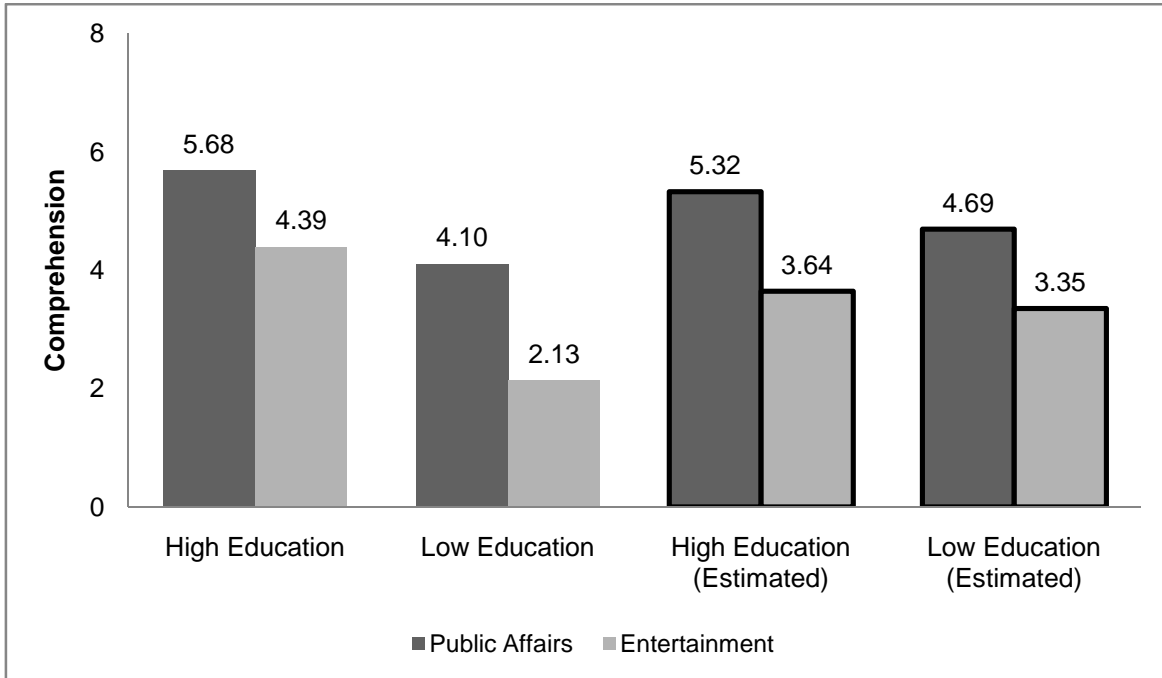
Observed Means and Estimated Means for Comprehension by Education and News Content

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Public affairs	5.68	.80	5.32 ^a	.16
Entertainment	4.39	2.56	3.64 ^a	.38
Low education				
Public affairs	4.10	1.42	4.69 ^a	.23
Entertainment	2.13	2.31	3.35 ^a	.55

Note. Values represent the average of comprehension scores on news stories which participants recalled from news reading. Comprehension scores were made on 8-point scales.

a. Covariates appearing in the model were evaluated at the following values: Age = 33.71, Weekly newspaper use = 147.00, Weekly Web use = 888.69, Weekly online news use = 235.92, Pre-exposure to print stimuli = 1.79, and Pre-exposure to online stimuli = .40.

Figure 4-3. Observed Means and Estimated Means for Comprehension by Education and News Content



Recognition of Story Exposure

There was no significant interaction effect for education and news content on participant recognition of news stories, $F(1, 118) = .16, p = .69, \eta^2 = .00$, from the within-subjects ANOVA test. Nor was there a significant effect for the between-subject portion, $F(1, 118) = 2.29, p = .13, \eta^2 = .02$: The average of public affairs and entertainment news recognition was not statistically different across the high education ($M = 10.51, SD = .64$) and the low education group ($M = 8.98, SD = .79$), despite the predicted direction of the means. Contrary to the prediction, a paired t -test shows that participants in the low education group recognized significantly more public affairs ($M = 14.50, SD = 9.46$) than entertainment news stories ($M = 3.46, SD = 3.46$), $t(47) = 9.27, p = .001$. This finding is summarized in Table 4-7 and Figure 4-4. Yet, in line with the prediction of hypothesis 2b, the high education group ($M = 16.38, SD = 9.40$) acquired better recognition

scores for public affairs news than the low education group, $t(120) = 1.22, p = .23$ —not at a statistically significant level, though.

A repeated measure ANCOVA test, controlling for covariate influences, revealed that the average of public affairs and entertainment news recognition was not significant, $F(1, 112) = .60, p = .44, \eta^2 = .01$, across the high ($M = 10.45, SE = .86$) and low education groups ($M = 9.08, SE = 1.17$), although the means were in the predicted direction. In addition, the low education group achieved higher scores for public affairs news recognition ($M = 14.35, SE = 2.04$) than for entertainment news ($M = 3.81, SE = .71$), after controlling for the covariates (see Table 4-7 and Figure 4-4). The direction of group means was contrary to the prediction. On the other hand, the means for the recognition of public affairs news were in the predicted direction. That is, those in the high education group ($M = 16.48, SE = 1.51$) recognized more public affairs news than their counterparts in the low education group, $F(1, 114) = .57, p = .45, \eta^2 = .01$, after adjusting for the covariates.

Table 4-7

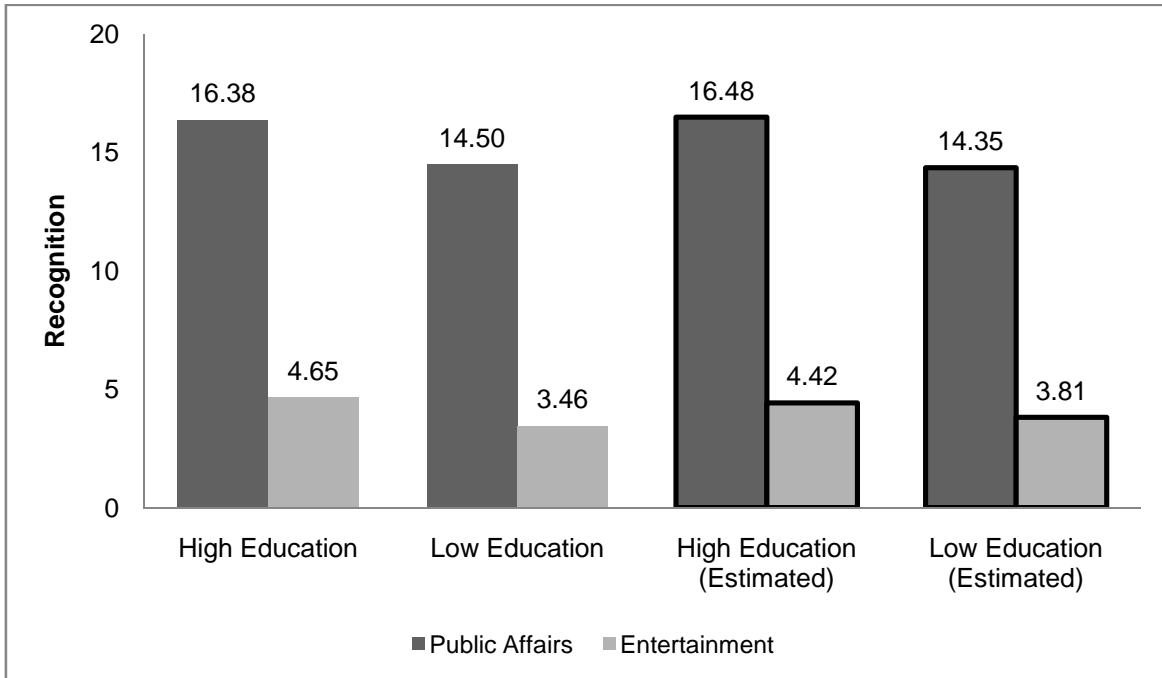
Observed Means and Estimated Means for Recognition by Education and News Content

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Public affairs	16.38	9.40	16.48 ^a	1.51
Entertainment	4.65	3.31	4.42 ^a	.52
Low education				
Public affairs	14.50	9.46	14.35 ^a	2.04
Entertainment	3.46	3.46	3.81 ^a	.71

Note. Recognition scores represent the number of news stories which participants recognized from news reading.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.47, Weekly newspaper use = 162.82, Weekly Web use = 911.10, Weekly online news use = 237.54, Pre-exposure to print stimuli = 1.87, and Pre-exposure to online stimuli = .48.

Figure 4-4. Observed Means and Estimated Means for Recognition by Education and News Content



In summary, the interaction effect for audience education and news content on knowledge acquisition was not consistent across free recall, comprehension, and recognition measures. Of the three indicators of knowledge acquisition, only free recall produced a significant interaction between education and news content. The direction of group means, however, was contrary to the prediction. That is, participants in the low education group recalled more public affairs than entertainment news stories. Comprehension and recognition measures showed similar results. On the other hand, public affairs knowledge acquisition delivered results in line with the prediction of hypothesis 2b. Indeed, more educated participants scored better than less educated participants across all three knowledge measures, as predicted. In conclusion, hypothesis 2b was partially supported, for public affairs news but not for entertainment news.

Hypothesis 3a: Main Effect for Presentation Mode on Public Affairs News Exposure

Hypothesis 3a predicted that participants' exposure pattern associated with public affairs news would be different across media outlets (newspapers, online). Specifically, the expectation was that people would read more public affairs news when they use a newspaper than when they use an online news source. The effect of media presentation mode on public affairs news exposure was significant, $F(1, 119) = 15.73, p = .001$, partial $\eta^2 = .12$ (see Table 4-8). As predicted, those in the newspaper group ($M = 83.33, SD = 14.93$) read more public affairs news than those in the online news group ($M = 72.20, SD = 15.12$). The effect of presentation mode remained significant after controlling for the effects of the covariates, $F(1, 113) = 13.38, p = .001$, partial $\eta^2 = .11$. As predicted, estimated marginal means for public affairs news exposure was significantly higher among newspaper readers ($M = 82.96, SE = 2.05$) than online news users ($M = 72.73, SE = 1.93$). These findings offer full support for hypothesis 3a.

It is noteworthy that of the six covariates, weekly Web use was significantly associated with public affairs news exposure, $F(1, 113) = 6.03, p = .02$, partial $\eta^2 = .05$, and age at a near significant level, $F(1, 113) = 1.54, p = .09$, partial $\eta^2 = .22$ (see Table 4-8). Partial correlation tests confirmed that heavy Web users spent more time reading public affairs news than light users, $pr = .23, p = .02$, and older participants read more public affairs news than younger counterparts, $pr = .16, p = .09$.

Table 4-8

Analysis of Variance and Covariance for Public Affairs News Exposure

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education (E)	1	2.09	.02	.15
Presentation mode (P)	1	15.73**	.12	.00
E x P	1	.12	.00	.73
Error	119	(225.31)		
Age	1	1.54 [†]	.22	.09
Weekly newspaper use	1	.12	.00	.73
Weekly Web use	1	6.03*	.05	.02
Weekly online news use	1	.77	.01	.38
Pre-exposure to print stimuli	1	1.00	.01	.32
Pre-exposure to online stimuli	1	.00	.00	.99
Education (E)	1	.03	.00	.86
Presentation mode (P)	1	13.38**	.11	.00
E x P	1	.24	.00	.63
Error	113	(.56)		

Note. Values in parentheses represent mean square errors.

[†] $p < .10$, * $p < .05$, ** $p < .01$

Hypothesis 3b: Main Effect for Presentation Mode on Public Affairs Knowledge Acquisition

Hypothesis 3b predicted that news media users would acquire more public affairs knowledge from a newspaper than an online news source, across free recall, comprehension, and recognition measures.

Free Recall

The effect of presentation mode on free recall of public affairs news was significant, $F(1, 117) = 4.71$, $p = .03$, partial $\eta^2 = .04$ (see Table 4-9). In line with the prediction, newspaper

readers ($M = 6.46$, $SD = 2.97$) recalled more public affairs news than online news users ($M = 5.48$, $SD = 2.60$). Inserting the covariates into the model slightly reduced the influence of presentation mode on free recall scores of public affairs news, $F(1, 111) = 3.56$, $p = .06$, partial $\eta^2 = .03$. Estimated marginal means for free recall was higher among those in the newspaper ($M = 6.06$, $SE = .34$) than online news group ($M = 5.21$, $SE = .31$), as predicted. None of the six covariates was significantly associated with free recall on public affairs news (see Table 4-9).

Table 4-9

Analysis of Variance and Covariance for Free Recall on Public Affairs News

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education (E)	1	54.97 ^{**}	.32	.00
Presentation mode (P)	1	4.71 [*]	.04	.03
E x P	1	.00	.00	.95
Error	117	(5.38)		
Age	1	.01	.00	.93
Weekly newspaper use	1	2.21	.02	.14
Weekly Web use	1	.09	.00	.76
Weekly online news use	1	.10	.00	.75
Pre-exposure to print stimuli	1	.01	.01	.93
Pre-exposure to online stimuli	1	.09	.00	.67
Education (E)	1	15.67 ^{**}	.12	.00
Presentation mode (P)	1	3.56 [†]	.03	.06
E x P	1	.06	.00	.80
Error	111	(5.51)		

Note. Values in parentheses represent mean square errors.

[†] $p < .10$, ^{*} $p < .05$, ^{**} $p < .01$

Comprehension

Hypothesis 3b predicted that participants in the newspaper condition would comprehend public affairs news better than those in the online news condition. As Table 4-10 shows, and contrary to the prediction, comprehension among the newspaper group ($M = 5.11$, $SD = 1.04$) was not significantly higher than the online news group ($M = 4.97$, $SD = 1.55$), $F(1, 119) = 2.08$, $p = .15$, partial $\eta^2 = .02$. Adding the six covariates in the model, however, produced a considerable adjustment to the effect of presentation mode on comprehension of public affairs news, $F(1, 113) = 5.49$, $p = .02$, partial $\eta^2 = .05$. Consistent with the prediction of hypothesis 3b, participants in the newspaper group ($M = 5.19$, $SE = .15$) comprehended public affairs news stories better than those in the online news group ($M = 4.82$, $SE = .20$).

Participant age was the only covariate associated significantly with public affairs news exposure, $F(1, 113) = 28.01$, $p = .001$, partial $\eta^2 = .20$ (see Table 4-10). Yet, pre-exposure to the print experimental stimuli had a near significant association, $F(1, 113) = 3.24$, $p = .08$, partial $\eta^2 = .03$. Partial correlation tests showed that the younger the participants, the better their comprehension of public affairs news, $pr = -.45$, $p = .001$, and the more they had pre-exposure to the newspaper stimuli, the better their comprehension, $pr = .17$, $p = .08$.

Table 4-10

Analysis of Variance and Covariance for Comprehension on Public Affairs News

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education (E)	1	68.82**	.37	.00
Presentation mode (P)	1	2.08	.02	.15
E x P	1	14.27**	.11	.00
Error	119	(1.03)		
Age	1	28.01**	.20	.00
Weekly newspaper use	1	.21	.00	.65
Weekly Web use	1	.14	.00	.71
Weekly online news use	1	.01	.00	.92
Pre-exposure to print stimuli	1	3.24 [†]	.03	.08
Pre-exposure to online stimuli	1	.04	.00	.85
Education (E)	1	1.44	.01	.23
Presentation mode (P)	1	5.49*	.05	.02
E x P	1	21.06**	.16	.00
Error	113	(.87)		

Note. Values in parentheses represent mean square errors.

[†] $p < .10$, * $p < .05$, ** $p < .01$

Recognition of Story Exposure

Hypothesis 3b predicted that participants in the newspaper group would recognize more public affairs news stories than those in the online news group. As predicted, the average number of recognized public affairs stories was significantly higher among newspaper ($M = 20.35$, $SD = 9.58$) than online news users ($M = 10.90$, $SD = 6.50$), $F(1, 118) = 38.38$, $p = .001$, partial $\eta^2 = .25$ (see Table 4-11). After adjusting for the effects of the covariates, the effect of presentation mode on public affairs news recognition remained significant, $F(1, 112) = 39.65$, $p = .001$, partial $\eta^2 = .26$. In line with the prediction of hypothesis 3b, estimated marginal means for the recognition

scores were significantly higher among newspaper ($M = 20.45$, $SE = 1.13$) than online news users ($M = 10.74$, $SE = 1.06$).

Table 4-11

Analysis of Variance and Covariance for Recognition on Public Affairs News

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education (E)	1	1.92	.02	.17
Presentation mode (P)	1	38.38**	.25	.00
E x P	1	.11	.00	.74
Error	118	(66.17)		
Age	1	.91	.01	.34
Weekly newspaper use	1	.00	.00	.98
Weekly Web use	1	4.92*	.04	.03
Weekly online news use	1	4.27*	.04	.04
Pre-exposure to print stimuli	1	.17	.00	.68
Pre-exposure to online stimuli	1	.71	.01	.40
Education (E)	1	.02	.00	.90
Presentation mode (P)	1	39.65**	.26	.00
E x P	1	.07	.00	.80
Error	112	(65.71)		

Note. Values in parentheses represent mean square errors.

* $p < .05$, ** $p < .01$

Of the six covariates, weekly Web use and online news use had significant associations with public affairs news recognition, $F(1, 112) = 4.92$, $p = .03$, partial $\eta^2 = .04$ and $F(1, 112) = 4.27$, $p = .04$, partial $\eta^2 = .04$, respectively (see Table 4-11). Partial correlation tests revealed that heavy Web users recognized a smaller number of public affairs news stories than light users, pr

= -.21, $p = .03$. By contrast, heavy online news users recognized more public affairs news than light users, $pr = .19$, $p = .04$.

Taken together, the results related to hypothesis 3b offer strong support. The effect of media presentation mode on public affairs knowledge acquisition was significant across free recall, comprehension, and recognition measures, particularly after controlling for the covariates. Thus, in line with the predictions of hypothesis 3b, participants in the newspaper group recalled and recognized more public affairs news stories and comprehended these stories better than those in the online news group. In short, hypothesis 3b was supported.

*Hypothesis 4a: Main effect for Presentation Mode on Entertainment News Exposure
in the Low Education Group*

Hypothesis 4a predicted that less educated people would spend more time with entertainment news stories when they use a Web-based news outlet than when they use a newspaper. As predicted, people in the low education group read more entertainment news from the online ($M = 24.84$, $SD = 17.39$) than newspaper source ($M = 14.83$, $SD = 16.64$), $F(1, 47) = 4.24$, $p = .04$, partial $\eta^2 = .08$, as shown in Table 4-12. Moreover, the effect of presentation mode on entertainment news exposure was significant after controlling for the impact of covariates, $F(1, 41) = 4.03$, $p = .05$, partial $\eta^2 = .09$, offering further support for the idea that those in the low education group read more entertainment news using the online ($M = 24.61$, $SE = 3.26$) than newspaper source ($M = 15.07$, $SE = 3.33$). Thus, hypothesis 4a was supported both with and without covariates.

Of the six covariates, only weekly Web use had a significant association with entertainment news exposure, $F(1, 41) = 6.03$, $p = .02$, partial $\eta^2 = .13$ (see Table 4-12). A partial

correlation test confirmed that the more participants used the Web, the less they read entertainment news stories, $r = -.36, p = .02$.

Table 4-12

Analysis of Variance and Covariance for Entertainment News Exposure for the Low Education Group

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Presentation mode	1	4.24*	.08	.04
Error	47	(289.87)		
Age	1	2.48	.06	.12
Weekly newspaper use	1	1.05	.03	.31
Weekly Web use	1	6.03*	.13	.02
Weekly online news use	1	.03	.00	.87
Pre-exposure to print stimuli	1	.02	.00	.89
Pre-exposure to online stimuli	1	.27	.01	.61
Presentation mode	1	4.03*	.09	.05
Error	41	(256.00)		

Note. Values in parentheses represent mean square errors.

* $p < .05$

Hypothesis 4b: Main effect for Presentation Mode on Entertainment Knowledge Acquisition in the Low Education Group

Hypothesis 4b predicted that less educated participants would acquire more entertainment knowledge from online news use than newspaper reading, across all three measures of knowledge acquisition.

Free Recall

There was a statistically significant effect for presentation mode on entertainment news recall for the low education group, $F(1, 41) = 11.42, p = .002$, partial $\eta^2 = .22$ (see Table 4-13). As predicted, the average number of entertainment news stories recalled was larger among the online ($M = 1.45, SD = 1.14$) than newspaper group ($M = .43, SD = .81$). Inserting the covariates into the model did not affect the significance of the effect of presentation mode, $F(1, 35) = 8.86, p = .01$, partial $\eta^2 = .20$. In line with the prediction of hypothesis 4b, the online news group ($M = 1.41, SE = .21$) recalled more entertainment news stories than the newspaper group ($M = .47, SE = .22$).

Table 4-13

Analysis of Variance and Covariance for Entertainment News Recall for the Low Education Group

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Presentation mode	1	11.42**	.22	.00
Error	41	(.99)		
Age	1	8.91**	.20	.01
Weekly newspaper use	1	.20	.01	.66
Weekly Web use	1	.28	.01	.60
Weekly online news use	1	.24	.01	.63
Pre-exposure to print stimuli	1	.86	.02	.36
Pre-exposure to online stimuli	1	.60	.02	.45
Presentation mode	1	8.86**	.20	.01
Error	35	(.88)		

Note. Values in parentheses represent mean square errors.

** $p < .01$

Participant age was the only covariate significantly associated with entertainment news recall (see Table 4-13). A partial correlation test shows that younger participants in the low

education group recalled more entertainment news stories than older participants in this education group, $pr = -.45, p = .01$.

Comprehension

The effect of presentation mode on comprehension of entertainment news was not significant for the low education group, $F(1, 41) = 2.59, p = .12$, partial $\eta^2 = .06$ (see Table 4-14), even though the average comprehension score for the online group ($M = 2.67, SD = 1.67$) was higher than the newspaper group's ($M = 1.56, SD = 2.55$). Controlling for the covariates did not change the outcome, $F(1, 35) = 1.82, p = .19$, partial $\eta^2 = .05$. Yet, the means for online news users ($M = 2.60, SE = .48$) and newspaper readers ($M = 1.63, SE = .49$) in the low education group were in the predicted direction.

Table 4-14

Analysis of Variance and Covariance for Entertainment News Comprehension for the Low Education Group

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Presentation mode	1	2.59	.06	.12
Error	41	(5.16)		
Age	1	4.22*	.11	.05
Weekly newspaper use	1	.01	.00	.92
Weekly Web use	1	.00	.00	.97
Weekly online news use	1	.23	.01	.64
Pre-exposure to print stimuli	1	.07	.00	.79
Pre-exposure to online stimuli	1	2.06	.06	.16
Presentation mode	1	1.82	.05	.19
Error	35	(4.63)		

Note. Values in parentheses represent mean square errors.

* $p < .05$

Of the six covariates, participant age was significantly associated with entertainment news comprehension, $F(1, 35) = 4.22, p = .05$, partial $\eta^2 = .11$, as presented in Table 4-14. A partial correlation test confirmed that the younger the participants, the better they comprehended entertainment news stories, $pr = -.33, p = .05$.

Recognition of Story Exposure

Hypothesis 4b predicted that people in the low education group would recognize more entertainment news stories using a Web-based news outlet than a newspaper. As predicted, results of an ANOVA test showed higher online ($M = 3.80, SD = 3.74$) than newspaper ($M = 3.09, SD = 3.18$) recognition scores for entertainment news, but not at a statistically significant level, $F(1, 46) = .50, p = .48$, partial $\eta^2 = .02$ (see Table 4-15). After adjusting for the covariates, the effect of presentation mode remained not significant, $F(1, 41) = .42, p = .52$, partial $\eta^2 = .01$. That is, estimated marginal means for the recognition of entertainment news were not statistically different across online ($M = 3.78, SE = .70$) and newspaper groups ($M = 3.11, SE = .73$).

Of the six covariates, participant age and weekly Web use both had almost significant associations with entertainment news recognition, $F(1, 41) = 3.69, p = .06$, partial $\eta^2 = .08$, and $F(1, 41) = 3.77, p = .06$, partial $\eta^2 = .09$, respectively (see Table 4-15). Partial correlation tests revealed that younger participants in the low education group recognized more entertainment news stories than older low education participants, $pr = -.29, p = .06$. Moreover, heavy Web users recognized less entertainment news stories than light users, $pr = -.29, p = .06$.

Table 4-15

Analysis of Variance and Covariance for Entertainment News Recognition for the Low Education Group

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Presentation mode	1	.50	.01	.48
Error	46	(12.13)		
Age	1	3.69 [†]	.08	.06
Weekly newspaper use	1	.30	.01	.59
Weekly Web use	1	3.77 [†]	.09	.06
Weekly online news use	1	.00	.00	.97
Pre-exposure to print stimuli	1	.29	.01	.60
Pre-exposure to online stimuli	1	.40	.01	.53
Presentation mode	1	.42	.01	.52
Error	40	(11.78)		

Note. Values in parentheses represent mean square errors.

[†]*p* < .10

In summary, support for the effect of media presentation mode on entertainment knowledge acquisition among less educated participants was inconsistent across free recall, comprehension, and recognition. Of the three dependent variables, only free recall was significantly associated with presentation mode. It is noteworthy though that the direction of means for comprehension and recognition was in line with the prediction. In conclusion, hypothesis 4b, which predicted that online news readers in the low education group would acquire more entertainment knowledge than newspaper readers, was partially supported—for free recall only.

Hypothesis 5a: Main Effect for Presentation Mode on Disorientation

Hypothesis 5a predicted that news media users would feel more disoriented when they use a Web-based news outlet than when they read a print newspaper. As shown in Table 4-16, the main effect for presentation mode on disorientation was not significant, $F(1, 119) = 1.13, p = .29$, partial $\eta^2 = .01$. Specifically, there was no statistical difference in the level of disorientation reported by newspaper ($M = 2.54, SD = .66$) and online news ($M = 2.67, SD = .85$) users. After controlling for the influence of the six covariates, presentation mode did not produce a significant effect on participant disorientation levels either, $F(1, 113) = .70, p = .40$, partial $\eta^2 = .01$. The direction of group means, however, was in line with the prediction of hypothesis 5a: Online news users ($M = 2.64, SE = .10$) reported slightly more disorientation than newspaper readers ($M = 2.52, SE = .10$). In conclusion, hypothesis 5a was not supported.

Of the six covariates, participant age and weekly use of online news were both almost significantly associated with disorientation, $F(1, 113) = 2.94, p = .09$, partial $\eta^2 = .03$, and $F(1, 113) = 3.11, p = .08$, partial $\eta^2 = .03$, respectively (see Table 4-16). The results of partial correlation tests showed that older participants were more disoriented than younger ones, $pr = .16, p = .90$, and that light online news users reported a higher level of disorientation than heavy online news users, $pr = .16, p = .80$.

Table 4-16

Analysis of Variance and Covariance for Disorientation

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education (E)	1	.47	.00	.49
Presentation mode (P)	1	1.13	.01	.29
E x P	1	1.28	.01	.26
Error	119	(.57)		
Age	1	2.94 [†]	.03	.09
Weekly newspaper use	1	.03	.00	.87
Weekly Web use	1	.20	.00	.66
Weekly online news use	1	3.11 [†]	.03	.08
Pre-exposure to print stimuli	1	1.90	.02	.17
Pre-exposure to online stimuli	1	.77	.01	.38
Education (E)	1	1.31	.01	.26
Presentation mode (P)	1	.70	.01	.40
E x P	1	1.30	.01	.26
Error	113	(.56)		

Note. Values in parentheses represent mean square errors.

[†]*p* < .10

Hypothesis 5b: Main Effect for Education on Disorientation

Hypothesis 5b predicted that less educated people would feel more disoriented than more educated people when they use news media. An ANOVA test showed that audience education did not produce a significant main effect on disorientation, $F(1, 119) = .47, p = .49$, partial $\eta^2 = .00$ (see Table 4-16). In fact, participants in the high education group ($M = 2.67, SD = .81$) reported feeling more disorientated than those in the low education group ($M = 2.52, SD = .67$), contrary to the prediction. Adding covariates to the model did not change the outcome. The

reported disorientation level for more educated participants ($M = 2.72$, $SE = .12$) was not statistically different than less educated participants ($M = 2.44$, $SE = .16$), $F(1, 113) = 1.31$, $p = .26$, partial $\eta^2 = .01$ (see Table 4-6). These results do not support hypothesis 5b.

Hypothesis 6a: Interaction Effect for Education and Presentation Mode on Disorientation

The forecast of hypothesis 6a was an interaction effect between audience education and presentation mode on disorientation. Specifically, this hypothesis predicted that those in the low education group would be more disoriented using the online than newspaper source, while those in the high education group would feel a similar amount of disorientation across the two media. There was not a significant interaction between audience education and presentation mode, $F(1, 119) = 1.28$, $p = .26$, partial $\eta^2 = .01$, as shown in Table 4-16. Controlling for the six covariates did not alter the outcome: The interaction effect remained not significant, $F(1, 113) = 1.30$, $p = .26$, partial $\eta^2 = .01$ (see Table 4-16).

Means and estimated marginal means for the disorientation index by education level and presentation mode are presented in Table 4-17 and Figure 4-5. The results show that among the four groups more educated participants in the online news group ($M = 2.79$, $SD = .89$) reported the highest level of disorientation while less educated participants reported the least amount of disorientation ($M = 2.49$, $SD = .76$). This pattern holds up with covariates included in the model. Furthermore, participants in the low education group did not report more disorientation with online news than newspaper use, $F(1, 41) = .01$, $p = .92$, $\eta^2 = .00$, after controlling for the covariates. In fact, the difference in reported disorientation levels across print and online news was larger for more educated (mean difference = .28) than less educated participants (mean difference = .04). These results provide evidence contrary to the prediction of hypothesis 6a.

Table 4-17

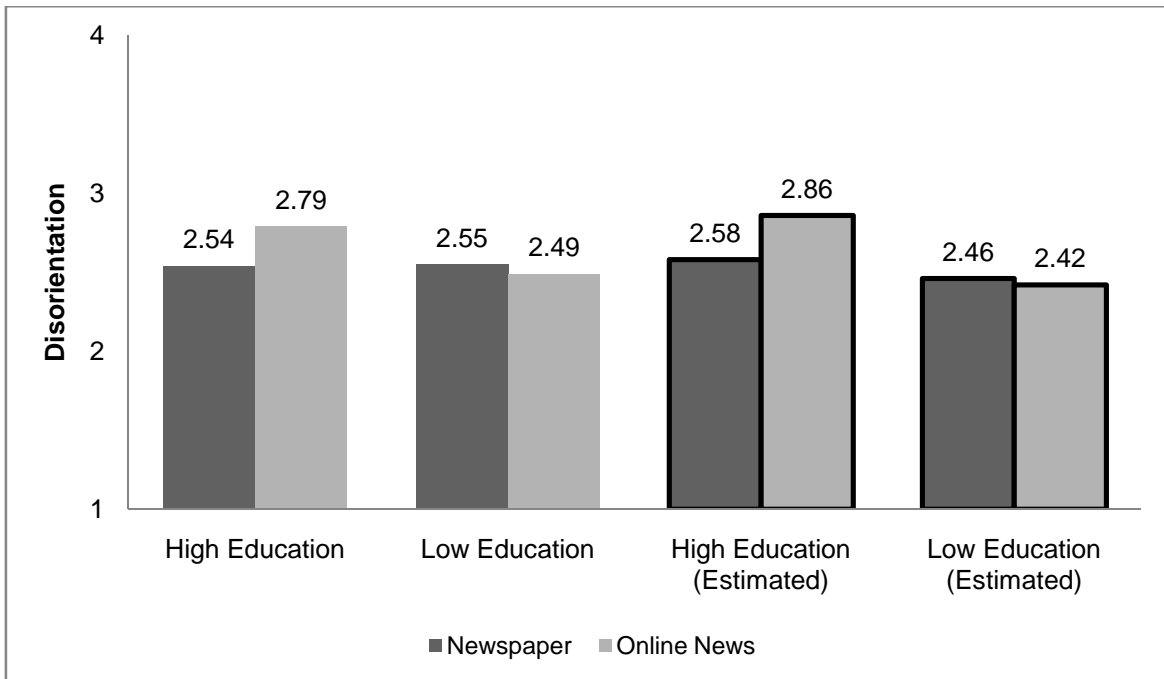
Observed Means and Estimated Means for Disorientation by Education and Presentation Mode

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Newspaper	2.54	.70	2.58 ^a	.15
Online news	2.79	.89	2.86 ^a	.15
Low education				
Newspaper	2.55	.59	2.46 ^a	.21
Online news	2.49	.76	2.42 ^a	.18

Note. Disorientation was made on 5-point scales. The higher the score, the greater the disorientation.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.44, Weekly newspaper use = 163.97, Weekly Web use = 908.88, Weekly online news use = 241.42, Pre-exposure to print stimuli = 1.89, and Pre-exposure to online stimuli = .49.

Figure 4-5. Observed Means and Estimated Means for Disorientation by Education and Presentation Mode



Hypothesis 6b: Interaction Effect for Education and Presentation Mode on Public Affairs News

Exposure

Hypothesis 6b predicted that people in the low education group would read less public affairs news when they use an online news outlet than when they read a newspaper and that the high education group would not differ in public affairs news exposure across the two news media. The interaction effect for education and presentation mode was not significant, $F(1, 119) = .12, p = .73$, partial $\eta^2 = .00$ (see Table 4-8). Nor was there a significant interaction between the two variables after controlling for the covariates, $F(1, 113) = .24, p = .63$, partial $\eta^2 = .00$. Table 4-18 and Figure 4-6 present means and estimated marginal means for public affairs news exposure by audience education and presentation mode. It is noteworthy though that in line with the prediction of hypothesis 6b, the low education group spent more time reading public affairs news in newspapers than online, $F(1, 41) = 4.03, p = .05, \eta^2 = .09$. The high education group, however, also read more public affairs news in newspapers than online, contrary to the prediction, $F(1, 66) = 11.77, p = .001, \eta^2 = .15$. Taken together, these results do not offer support for hypothesis 6b.

Table 4-18

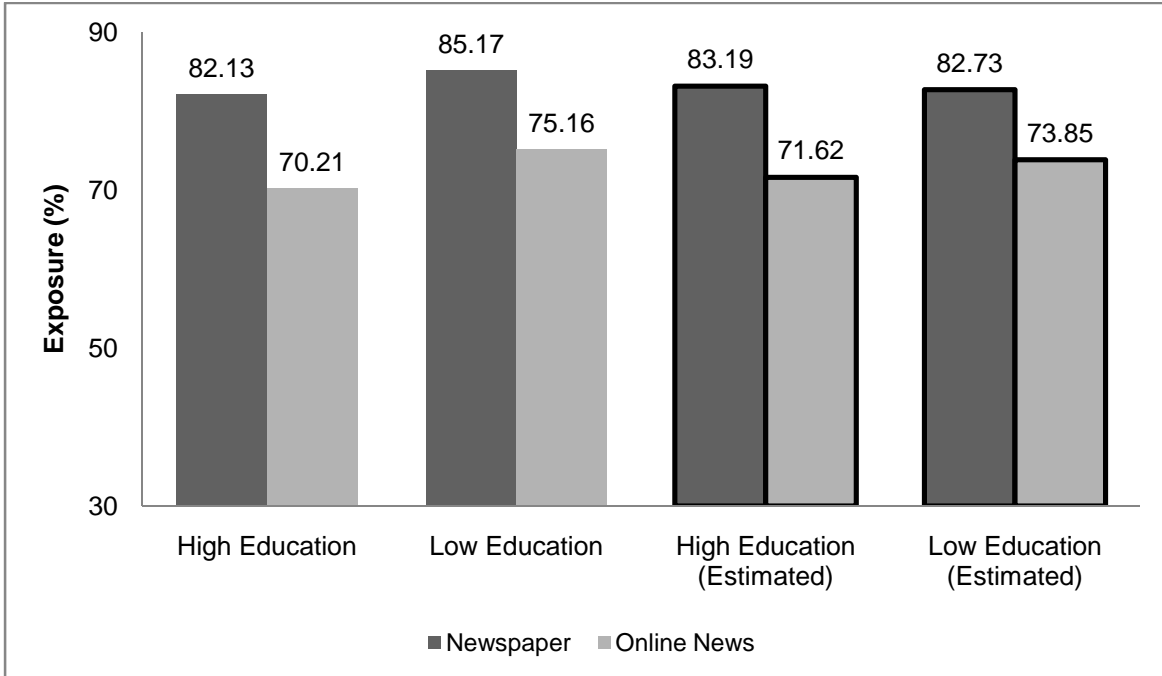
Observed Means and Estimated Means for Public Affairs News Exposure by Education and Presentation Mode

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Newspaper	82.13	13.82	83.19 ^a	2.90
Online news	70.21	13.24	71.62 ^a	2.97
Low education				
Newspaper	85.17	16.64	82.73 ^a	4.13
Online news	75.16	17.39	73.85 ^a	3.60

Note. Public affairs news exposure represents the proportion (%) of public affairs news of total news exposure.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.44, Weekly newspaper use = 163.97, Weekly Web use = 908.88, Weekly online news use = 241.42, Pre-exposure to print stimuli = 1.89, and Pre-exposure to online stimuli = .49.

Figure 4-6. Observed Means and Estimated Means for Public Affairs News Exposure by Education and Presentation Mode



Hypothesis 6c: Interaction Effect for Education and Presentation Mode on Public Affairs Knowledge Acquisition

Hypothesis 6c predicted that the low education group would acquire less public affairs knowledge using an online news source than reading a newspaper; on the other hand, the high education group would acquire a similar amount of knowledge across the two media.

Free Recall

There was not a significant interaction effect for education and presentation mode on public affairs news recall, $F(1, 117) = .004, p = .95, \text{partial } \eta^2 = .00$ (see Table 4-9). Inserting the

six covariates into the model did not produce a considerable adjustment on the interaction effect either, $F(1, 111) = .06, p = .80, \text{partial } \eta^2 = .00$ (see Table 4-9). Means and estimated marginal means for free recall by education level and presentation mode are displayed in Table 4-19 and Figure 4-7. It is noteworthy though that group means were in the predicted direction. The low education group recalled less public affairs news from online than newspaper reading, $F(1, 40) = 5.00, p = .03, \eta^2 = .11$, and the high education group did not recall online and the print news at statistically different levels, $F(1, 65) = .82, p = .37, \eta^2 = .01$, after controlling for the covariates. Yet, the difference in the number of recalled news stories in the two media groups was not statistically significant across the high (mean difference = .74) and the low education (mean difference = .98) groups.

Table 4-19

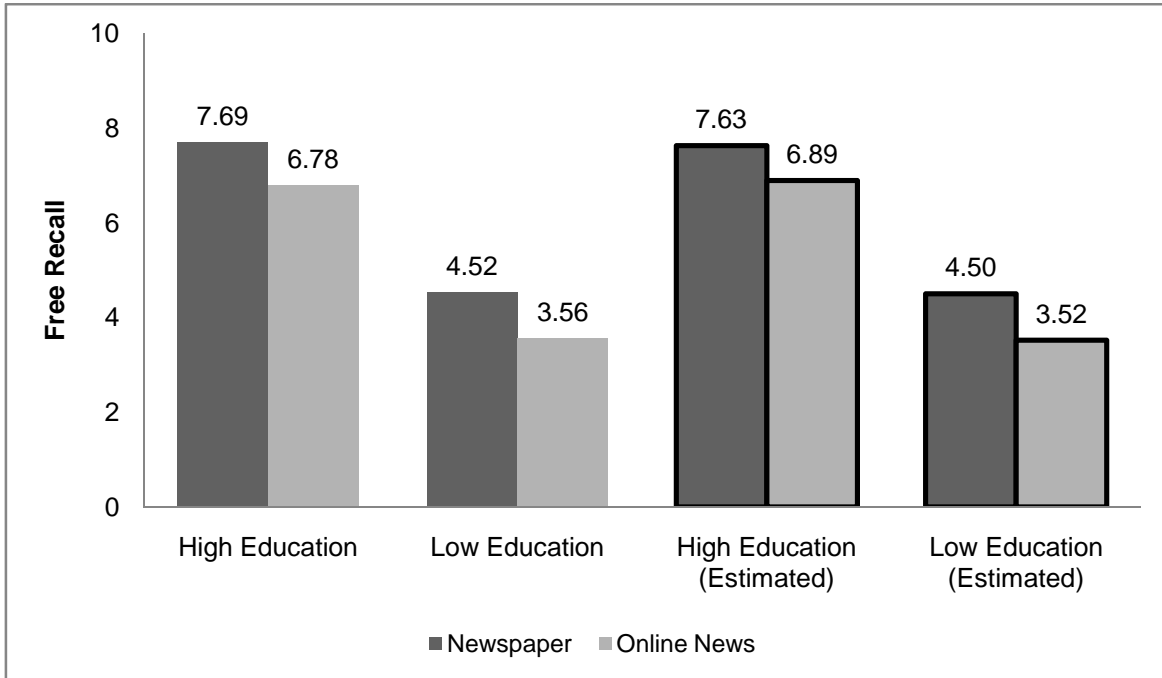
Observed Means and Estimated Means for Public Affairs News Recall by Education and Presentation Mode

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Newspaper	7.69	3.00	7.63 ^a	.47
Online news	6.78	2.36	6.89 ^a	.49
Low education				
Newspaper	4.52	1.59	4.50 ^a	.70
Online news	3.56	1.56	3.52 ^a	.58

Note. Free recall scores represent the number of news stories which participants correctly recalled from news reading.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.62, Weekly newspaper use = 163.96, Weekly Web use = 901.34, Weekly online news use = 241.94, Pre-exposure to print stimuli = 1.90, and Pre-exposure to online stimuli = .49.

Figure 4-7. Observed Means and Estimated Means for Public Affairs News Recall by Education and Presentation Mode



Comprehension

Hypothesis 6c predicted that the low education group’s comprehension of public affairs news would be worse when they use a Web-based news source than when they read a print newspaper, while the high education group would not differ in comprehending public affairs news across the two media. As predicted, the interaction effect for education and presentation mode was significant, $F(1, 119) = .14.27, p = .001, \text{partial } \eta^2 = .11$ (see Table 4-10). After controlling for covariates, the interaction effect remained significant, $F(1, 113) = 21.06, p = .001, \text{partial } \eta^2 = .16$. As presented in Table 4-20 and Figure 4-8, the comprehension scores for the low education group was higher among newspaper readers than online news users, $F(1, 41) = 12.25, p = .001, \eta^2 = .23$, after controlling for the covariates. Also, more educated participants showed a smaller difference (mean difference = .38) in comprehension between the two media groups, $F(1, 66) = 3.19, p = .08, \eta^2 = .05$, compared to less educated participants (mean difference = 1.22). These results provide strong support for hypothesis 6c.

Table 4-20

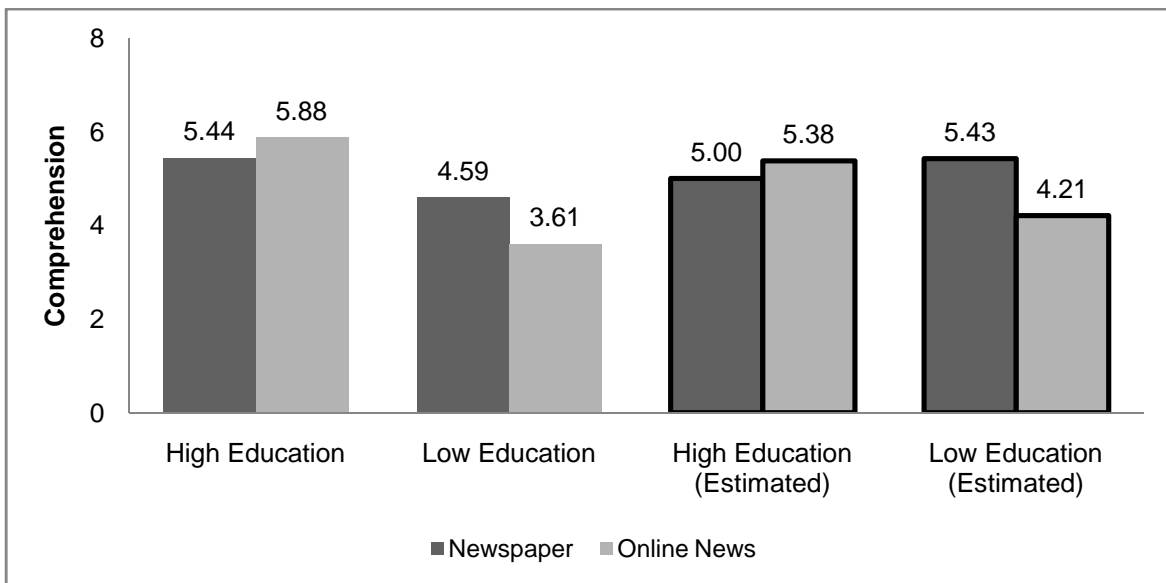
Observed Means and Estimated Means for Public Affairs News Comprehension by Education and Presentation Mode

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Newspaper	5.44	.71	5.00 ^a	.18
Online news	5.88	.82	5.38 ^a	.19
Low education				
Newspaper	4.59	1.26	5.43 ^a	.26
Online news	3.61	1.37	4.21 ^a	.23

Note. Values represent the average of comprehension scores on news stories which participants recalled from news reading. Comprehension scores were made on 8-point scales.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.44, Weekly newspaper use = 163.97, Weekly Web use = 908.88, Weekly online news use = 241.42, Pre-exposure to print stimuli = 1.89, and Pre-exposure to online stimuli = .49.

Figure 4-8. Observed Means and Estimated Means for Public Affairs News Comprehension by Education and Presentation Mode



Recognition of Story Exposure

Hypothesis 6c made the forecast that less educated participants would recognize a smaller number of public affairs news stories using the online than newspaper source and that more educated participants would not vary in how many public affairs news stories they recognize across the two media sources. As shown in Table 4-11, there was no significant interaction effect for audience education and presentation mode on public affairs news recognition, $F(1, 118) = .11$, $p = .74$, partial $\eta^2 = .00$. Adding the covariates to the model did not produce a significant effect either, $F(1, 112) = .07$, $p = .80$, partial $\eta^2 = .00$ (see Table 4-11).

Means and estimated marginal means for recognition by audience education and presentation mode are presented in Table 4-21 and Figure 4-9. As predicted, the low education group recognized a smaller number of public affairs news stories from online than newspaper reading, $F(1, 41) = 15.09$, $p = .001$, $\eta^2 = .27$, after controlling for the covariates. Yet, the high education group also showed a considerable difference in public affairs story recognition between the two media groups, $F(1, 65) = 22.65$, $p = .001$, $\eta^2 = .26$. Contrary to what hypothesis 6c predicted, the high education group recognized more newspaper than online stories, mirroring the findings for the low education group.

In summary, the results across the three knowledge acquisition measures were inconsistent. Of the three variables, only comprehension was significantly associated with the interaction between education and presentation mode factors, producing the only support for hypothesis 6c. For free recall and recognition the low education group showed statistically lower scores associated with the online than newspaper source, in line with the prediction of hypothesis 6c. However, unlike what was expected, comparisons across the two education groups show that they performed similarly across the two media sources. In conclusion, hypothesis 6c was partially supported—for the comprehension measure only.

Table 4-21

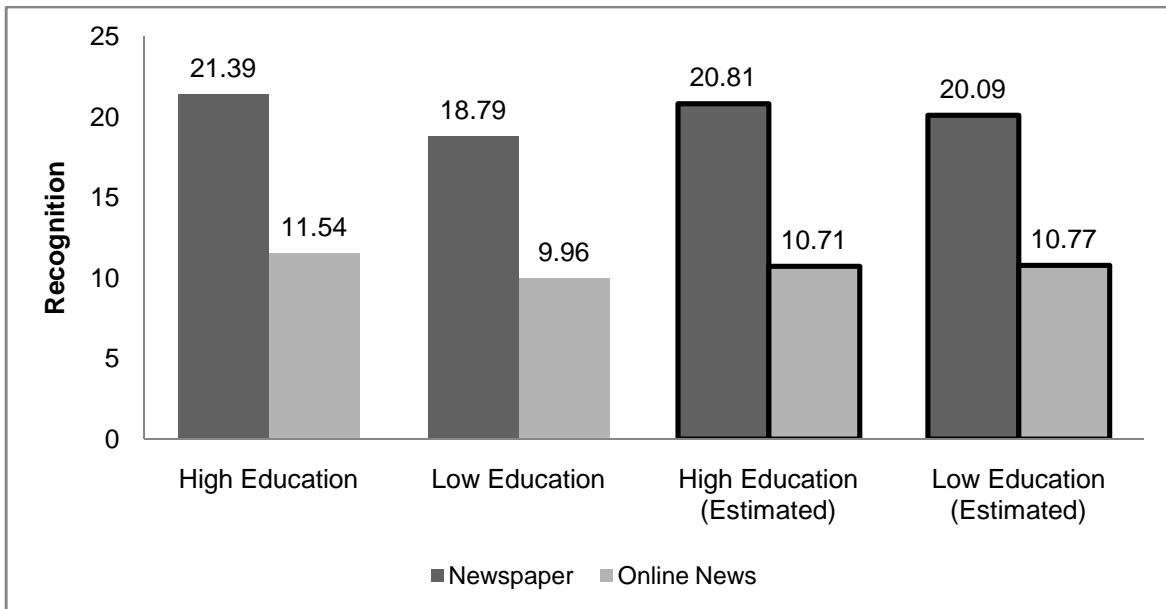
Observed Means and Estimated Means for Public Affairs News Recognition by Education and Presentation Mode

Group	Observed Mean	SD	Estimated Mean	SE
High education				
Newspaper	21.39	9.57	20.81 ^a	1.61
Online news	11.54	6.01	10.71 ^a	1.64
Low education				
Newspaper	18.79	9.59	20.09 ^a	2.26
Online news	9.96	7.19	10.77 ^a	1.98

Note. Recognition scores represent the number of news stories which participants recognized from news reading.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.50, Weekly newspaper use = 163.60, Weekly Web use = 909.45, Weekly online news use = 239.95, Pre-exposure to print stimuli = 1.90, and Pre-exposure to online stimuli = .49.

Figure 4-9. Observed Means and Estimated Means for Public Affairs News Recognition by Education and Presentation Mode



Testing for Differences between Behavioral and Self-Report Measures of News Exposure

Media researchers generally show a high level of confidence in self-report measures of exposure to media content, despite several studies that report findings to the contrary (Bechtel, et al., 1972; Papper, et al., 2004; Steiner, 1966; Tewksbury, 2003). This study employed two separate measures of news exposure, offering an opportunity to make comparisons across self-report and behavioral measures. Although no predictions were made, valuable findings emerged and those will be reported here.

Of the two exposure indicators, the behavioral measure was used for hypotheses testing in this study. The self-report measure was adopted for comparison with the behavioral measure. Paired sample *t*-tests were conducted to examine whether there were statistical differences between the two measures. The results showed a significant difference between the two exposure measures, $t(121) = 6.83, p = .001$. Specifically, participants under-reported exposure (9.3%) to public affairs news ($M = 68.42, SD = 17.66$) and over-reported entertainment news ($M = 31.58, SD = 17.66$) exposure.¹⁷ In order to investigate the relationship of self-reported news exposure error rates and the independent variables employed in this study, the proportional difference between behavioral and self-report news exposure was subjected to an Education (2) x Presentation Mode (2) ANOVA and an ANCOVA with the covariates, as was done for the hypotheses testing of the three main dependent variables.

As shown in Table 4-22, the error rate for self-reported exposure had a near significant association with presentation mode, $F(1, 119) = 3.28, p = .07, \eta^2 = .03$. That is, underestimation of public affairs news exposure (i.e., overestimation of entertainment news exposure) was higher among newspaper readers ($M = 11.37, SD = 15.93$) than online news users ($M = 7.32, SD =$

¹⁷ Data from the behavioral measure show that participant exposure proportions for public affairs and entertainment news were 77.7% and 22.3% respectively.

14.05). After controlling for the covariates, however, the influence of presentation mode declined to a statistically non-significant level, $F(1, 113) = 2.18, p = .14, \eta^2 = .02$. Audience education had no significant effect on the error rate of self-reported news exposure, with and without including covariates into the analyses (see Table 4-22). On the other hand, there was an almost significant interaction effect between education and presentation mode on the error rate, when controlling for the covariates, $F(1, 113) = 3.40, p = .07, \eta^2 = .03$.

Table 4-22

Analysis of Variance and Covariance for Proportional Difference between Behavioral and Self-Report News Exposure

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Education (E)	1	.32	.00	.57
Presentation mode (P)	1	3.28 [†]	.03	.07
E x P	1	2.67	.02	.11
Error	119	(223.67)		
Age	1	.95	.01	.33
Weekly newspaper use	1	2.06	.02	.15
Weekly Web use	1	6.02*	.05	.02
Weekly online news use	1	.93	.01	.34
Pre-exposure to print stimuli	1	1.77	.02	.19
Pre-exposure to online stimuli	1	.37	.00	.54
Education (E)	1	.04	.00	.84
Presentation mode (P)	1	2.18	.02	.14
E x P	1	3.40 [†]	.03	.07
Error	113	(216.88)		

Note. Values in parentheses represent mean square errors.

[†] $p < .10, * < .05$

Table 4-23 presents observed means and estimated marginal means for behavioral and self-report measures by education and presentation mode.¹⁸ In addition, Figure 4-10 illustrates the interaction effect for audience education and presentation mode on the proportional difference between behavioral and self-report measures. The difference between the print and online news conditions for more educated participants was considerably smaller than for less educated counterparts. In fact, newspaper readers in the low education group underestimated their exposure to public affairs news (and overestimated entertainment news exposure) approximately three times more than online news users. Of the four groups, the low-education online-news group showed the lowest error rate for self-reported news exposure.

Participant weekly Web use was the only covariate which had a significant association with the proportional difference between behavioral and self-report measures, $F(1, 113) = 6.02, p = .02, \eta^2 = .05$ (see Table 4-22). A partial correlation test confirmed that heavy Web users underestimated their exposure to public affairs news (and overestimated exposure to entertainment news) more than light users, $pr = .23, p = .02$.

¹⁸ Even though Table 4-23 includes public affairs news exposure only, information about entertainment news exposure is also reflected in it. Because the sum of public affairs and entertainment news exposure for an individual participant is always 100%, the error rate (underestimation) of the self-report exposure for public affairs news is exactly same with that (overestimation) for entertainment news.

Table 4-23

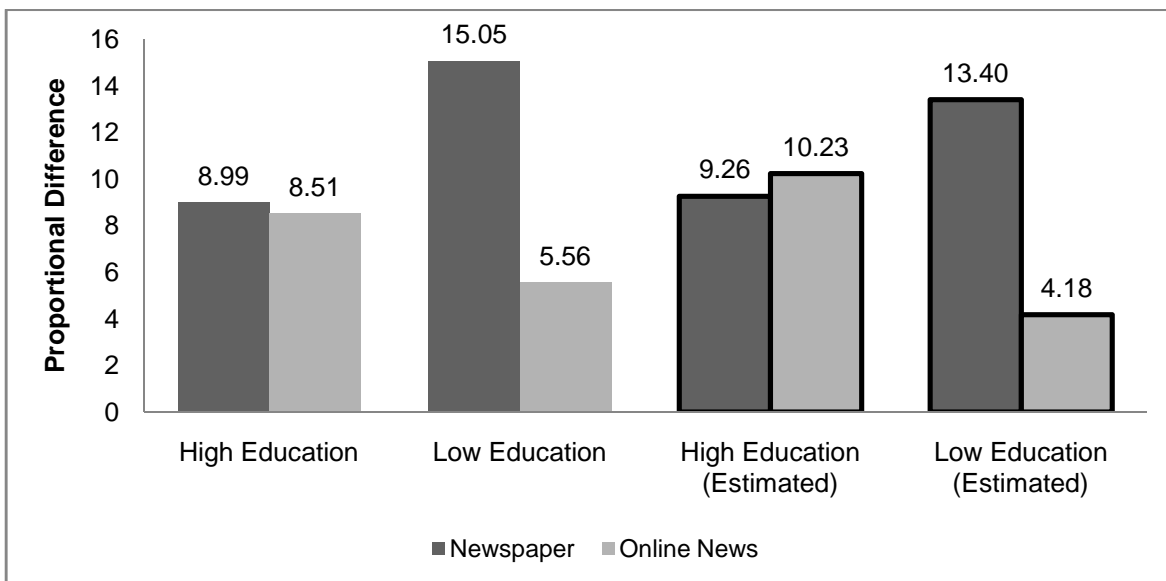
Observed Means and Estimated Means for Behavioral and Self-Report Measures of Public Affairs News Exposure by Education and Presentation Mode

Group	<u>Observed Means</u>		<u>Estimated Means</u>	
	<u>Observational (SD)</u>	<u>Self-Report (SD)</u>	<u>Observational (SE)</u>	<u>Self-Report (SE)</u>
High education				
Newspaper	82.13(13.82)	73.24(20.89)	83.19(2.90) ^a	74.07(3.41) ^a
Online news	70.21(13.24)	61.70(16.07)	71.62(2.97) ^a	61.40(3.50) ^a
Low education				
Newspaper	85.17(16.64)	70.13(15.97)	82.73(4.13) ^a	69.31(4.87) ^a
Online news	75.16(17.39)	69.69(13.76)	73.85(3.60) ^a	69.64(4.25) ^a

Note. Public affairs news exposure represents the percentage that it occupies in the total news exposure time. Thus, the sum of public affairs and entertainment news exposure for each participant adds up to 100%.

a. Covariates appearing in the model were evaluated at the following values: Age = 34.44, Weekly newspaper use = 163.97, Weekly Web use = 908.88, Weekly online news use = 241.42, Pre-exposure to print stimuli = 1.89, and Pre-exposure to online stimuli = .49.

Figure 4-10. Proportional Difference between Behavioral and Self-Report Measure for Public Affairs News Exposure by Education and Presentation Mode



CHAPTER 5

Discussion

The primary purpose of this dissertation is to empirically investigate the possibility that new media use exacerbates the information gap across different educational groups, compared to traditional media use. The current study incorporates the strengths of both survey and experiment traditions of knowledge gap research. First, this study follows the survey research tradition by attending to social structural aspects of the knowledge gap phenomenon in line with the original knowledge gap theory; by using professionally produced news media as experimental stimuli to enhance external validity. At the same time, this study takes advantage of the benefits of experimental research by employing controlled experimental procedures and rigorous memory measures for the investigation of the knowledge gap phenomenon. Moreover, this project is centrally concerned with aspects of the knowledge gap that have been somewhat neglected in past empirical research. Specifically, exposure preferences (public affairs vs. entertainment news) among media users have not enjoyed much focus in knowledge gap studies. Participant news exposure was measured in this dissertation project using a more objective and rigorous procedure than the typical self-report measure, employed in the few studies that have investigated this variable. A behavioral measure of exposure was used and comparisons were drawn with self-report measures.

To test the hypotheses of this study, an audience education (high and low education) by presentation mode (newspaper and online news) by news content (public affairs and entertainment news) mixed factorial experimental design was used. The first two variables (audience education and presentation mode) were treated as between-subjects factors and the third (news content) was manipulated as a within-subjects factor.

This study has three main dependent variables: disorientation, news exposure, and knowledge acquisition. Knowledge acquisition was measured through multiple measures (free recall, comprehension, and recognition of story exposure) primarily because each measure is expected to reveal different aspects of memory. A couple of media use variables were also measured and treated as covariates in statistical analysis because they were expected to affect the relationships between experimental factors and dependent variables.

This chapter, discussing the results reported in the previous chapter, is composed of three sections. First, summaries and interpretations of results will be presented for each dependent variable. This section will focus on addressing possible explanations for findings that were contrary to hypotheses as well as findings that did not achieve statistical support. Second, implications of supported predications will be addressed in terms of their theoretical and empirical value for knowledge gap research as well as for the “learning from media” body of scholarship. Finally, the shortcomings of this study will be contemplated and suggestions for future research will be offered.

Summary and Interpretations of Findings

Disorientation

Based on theoretical considerations and empirical findings of past research, this study investigated three hypotheses regarding the influence of formal education and media presentation mode on participant feeling of disorientation: two for main effects and the other for an interaction effect. Specifically, the hypotheses predicted (1) higher levels of disorientation associated with online than newspaper use (hypothesis 5a); (2) higher levels of disorientation among less educated than more educated participants (hypothesis 5b); (3) that the low education group would report more disorientation using the online than newspaper source while the high

education group would report similar levels of disorientation using the two media outlets (hypothesis 6a).

Statistical tests showed that none of these hypotheses was supported. In fact, contrary to expectation, self-reported disorientation did not statistically vary across newspaper and online news conditions or across education groups. The direction of means did not offer consistent cues of support for expectations either. Specifically, while the direction of means for the two media groups was in line with the prediction (online news users reported a slightly higher level of disorientation than the print news group), the means for the two education groups were counter to the predicted direction. Indeed, more educated participants reported a slightly higher level of disorientation than the low education group. Moreover, unlike the predication that the highest level of disorientation would be associated with lower education online news users, the higher education online news group reported the highest level of disorientation. The high education newspaper group reported the second highest level of disorientation, followed by the low education newspaper and low education online news groups. Thus, the group expected to report the *highest* level of disorientation (online low education) reported the *least* amount of disorientation. A number of possible explanations for these unexpected findings will be discussed: measurement validity of the disorientation index, social desirability of self-report measures, and computer self-efficacy of the low education group.

Measurement validity of disorientation index. The study reported here used a disorientation index that produced meaningful findings in one past study (Eveland, Marton, et al., 2004). However, the previous study examined different levels of disorientation across two distinct versions of an experimental news site, while this study investigated differences across print and online news sources. It is possible that the index has more potential as an instrument testing disorientation levels across different online news sites than across different news media.

The index has not been tested in either cross media or non-online research and has therefore not yet been validated. Indeed, the reliability score for the index was not very high ($\alpha = .68$), despite being acceptable. Further analyses, after splitting the data into two media groups, show considerable difference in the reliability score between the online ($\alpha = .76$) and print ($\alpha = .56$) condition. This finding confirms that the disorientation index is not a reliable instrument for newspaper use. As such, the study reported here does not offer great optimism about the potential of this index for cross media comparisons. It might be important though for future research undertakings to include the disorientation index among dependent variables so that its strengths and weaknesses for indexing this psychological/cognitive state can be teased out. Certainly, the matter of disorientation is a pressing issue in the context of emerging media use.

Social desirability of self-report measures. Another possible explanation for such unexpected findings is the social desirability effect that frequently occurs with self-report measures (see Moorman & Podsakoff, 1992 for a review). Social desirability refers to respondent tendencies to report behavior, opinions, attitudes, or feelings in accordance with what they perceive to be socially desirable (Furnham, 1986; Nederhof, 1985). Such response biases might originate from shortcomings associated with the questionnaire or from respondent motivations (Furnham, 1986; Nicotera, 1996). These biases are particularly problematic when they impact individual participants differently within the parameters of a single study (Nicotera, 1996).

It is actually possible that cultural differences might affect participant motivations to provide socially desirable responses. Previous research on the influence of cultural effects on social desirability biases has found considerable differences across cultures (DiTomaso, Kirby, Milliken, & Triandis, 1998; Middleton & Jones, 2000). Differences between Eastern and Western cultures are particularly prominent and likely to affect participant motivations for social approval (Geletkanycz, 1997; Middleton & Jones, 2000). For example, the strong collectivist

sensibilities of Eastern cultures might instigate more pressure on participants to conform to dominant norms, and accordingly, produce a stronger need for societal approval compared to participants who belong to individualistic Western cultures (Middleton & Jones, 2000). Thus, it is not surprising that people from Eastern cultures are more vulnerable to social desirability bias than Westerners. Unlike the Eveland et al. (2004) study which was conducted in the US, data for the study reported here was collected in South Korea where collectivism is a strong and widely shared cultural value. This cultural influence might have affected participant responses in an experimental setting. The question remains if potential cultural influences affected all respondents in this study or if specific subgroups were disproportionately vulnerable to social desirability effects.

As argued earlier in the method chapter, there was a substantial age difference between the two education groups that participated in this study. In fact, the average age for the high education group was in the mid-twenties while the low education group's mean age was around forty five. Even though age was statistically controlled in covariate analyses, the generational gap might have effects on participant responses to self-report measures, which cannot be accounted for in post-hoc statistical procedures. Younger generations of South Koreans are more individualistic and therefore perhaps less concerned about social approval than older generations. Westernization, as a by-product of globalization, is indeed more pronounced among younger than older generations of Easterners. It is therefore reasonable to argue that younger participants in the high education group might be more immune to social desirability effects than older participants in the low education group. In summary, different levels of susceptibility to social desirability bias across the two education groups, further enhanced by age differences, might be an explanation for why less educated participants did not report a higher level of disorientation than the more educated group. Moreover, the education factor itself might provide an additional explanation for the unexpected findings. People with lower levels of education might not be

cognitively well equipped to remember and therefore report the disorientation they experienced during experimental exposure to stimuli. Thus, beyond social desirability bias, participants in the low education group might have experienced difficulty with the self-report procedure.

Computer self-efficacy through training. As noted above, the low education online news group deviated most prominently from the prediction for disorientation level. They were expected to report the *highest* level of disorientation among the four experimental groups but reported the *lowest* level of disorientation. This result might, at least partly, be due to the fact that approximately two thirds of participants in the low education group were enrolled in computer or Internet classes at the time of their participation in the experiment. A number of studies have produced compelling evidence of positive correlations between computer-efficacy and related performances (Gist, Schwoerer, & Rosen, 1989; Kinzie, et al., 1994; Reed, Doty, & May, 2005; Tsai & Tsai, 2003). Empirical findings have also shown that training can enhance self-efficacy toward computer and Internet use (Cassidy & Eachus, 2002; Chou, 2001; Compeau & Higgins, 1995; Torkzadeh, Pflughoeft, & Hall, 1999; Torkzadeh & van Dyke, 2002). Some scholars emphasize the importance of computer training, arguing that enhancing computer self-efficacy through training programs might be more effective than improving interface design for user friendliness (Venkatesh & Davis, 1996). Research shows that among older users, increased computer-related self-efficacy improves computer skill learning and computer efficacy can be enhanced through computer education (Charness, Schumann, & Boritz, 1992; Dyck & Smither, 1994; Laganà, 2008; Lam & Lee, 2007). Given that many older participants in the low education group made an active decision to learn computer skills, they might have been highly motivated to report efficiency in using computer skills. Indeed, they had already completed part of a computer course when they participated in the experiment and their self-efficacy toward computer use might be somewhat higher than non-trainees in their age group. It seems likely that enhanced self-efficacy due to computer education might have encouraged some participants to report lower

levels of disorientation than might have been the case if they were not taking instructional courses on computer use. It is also possible that participants who were taking computer classes truly experienced relatively low levels of disorientation because of improved computer skills and that their responses were not driven by inflated self-efficacy toward computer use.

In fact, the average Web experience for the low education group was around five years ($M = 4.75, SD = 3.77$), despite being significantly shorter than the high education group's ($M = 8.92, SD = 1.94$), $t(65.08) = 7.15, p = .001$. Given the relatively long Web experience for both education groups, participants might not have felt a considerable amount of disorientation, at least not due to insufficient system experience. Moreover, several features typical to online news sites were eliminated from the experimental site. These eliminated features might be the ones that have the potential to trigger feelings of disorientation. Indeed, news story search functions and links to related news stories were not included in the experimental site with the goal to equalize informational volume across the two news sources. It can be argued that eliminating these features might have reduced disorientation considerably.

News Exposure

Four research hypotheses were formulated to investigate relationships between the three independent variables (audience education, presentation mode, and news content) and participant news exposure. Hypothesis 2a prompted an investigation of education level influences on news selection. This hypothesis predicted that the low education group would prefer entertainment over public affairs news and that the high education group would show greater preference for public affairs news compared to the low education group. Related to this, hypothesis 3a made predictions for channel influences. Specifically, newspaper readers were expected to expose themselves to a larger amount of public affairs news than online news users. Hypothesis 4a also made a forecast for an effect of presentation mode on news exposure. Less educated participants

were expected to expose themselves to more entertainment news using the online than newspaper source. Finally, hypothesis 6b posed a prediction for an interaction effect between education and news medium on public affairs news exposure. Specifically, the expectation was that less educated participants would expose themselves to a smaller amount of public affairs news using the online than newspaper source while more educated participants would expose themselves to the same amount of public affairs news across the two media.

Results were mixed. First, the low education group did not have an exposure preference for entertainment over public affairs news. In fact, they spent more time with public affairs than entertainment news and their exposure to public affairs news was practically equal to the high education group's. Second, newspaper readers (overall considered) read more public affairs news than online news users, as predicted. Third, less educated people read more entertainment news stories from the online news outlet than from the newspaper, consistent with the prediction. Fourth, participants (irrespective of their education level) chose to read more public affairs news stories in print than online, which does not support the predicted interaction effect between education and medium on the exposure measure. Several explanations for these unexpected findings deserve consideration.

Generation gap. Less educated people's relatively low preference for entertainment news stories might be partly due to the age difference between the two education groups as discussed above in terms of the disorientation measure. Media use might be dependent on age as much as social status of consumers. Conventional wisdom suggests that older generations are more interested in public affairs news than young people. Predicted differences in the news exposure patterns of different education groups were most likely erased by the generation gap between high and low education participants. In other words, higher preference for public affairs news among more educated participants might have been cancelled out by similarly high public affairs

preferences among low education participants who were also significantly older than the high education group. If the participants in the two education groups were similar in age, less educated participants might have varied from their more educated counterparts on exposure preference. Even though age was controlled in statistical analyses, the generation gap might impact participant behavior in ways that cannot be accounted for in post-hoc statistical procedures.

Prior exposure. As a means to control for pre-exposure to the experimental stimuli and other media, time delay (approximately a month) was built into the design of this study to allow for natural memory decay to run its course. Nevertheless, prior exposure to the stimuli and other news media might have affected choices about news exposure in the experiment. News stories featured in the experimental stimuli were evolving over time, and appeared in many media outlets as news events typically do. Hence, it is likely that in the period between stimuli selection and data collection participants, especially heavy news consumers, had considerable pre-exposure to some of the news events. One can therefore expect the news stories featured in the experimental stimuli to be perceived as old news, and not very likely to draw attention. In other words, a ceiling effect from prior exposure might have prevented participants from paying attention to heavily publicized stories during their participation in the experiment. Such a ceiling effect is expected to be prominent among the high education group participants who are more likely to be heavy news media users than the low education group. Data for participant exposure to distinct topics of public affairs news, which was not reported in the results section, provides some supporting evidence for this inference.

As explained in the method section, public affairs news exposure was derived from summing proportions of exposure to such topical categories as political, international, national, and regional affairs. International news has been identified as one of the least popular news

topics across different news media (Bennett, 2001; Graber, 1984, 1988), and recent empirical findings have shown that news users' preference for international news stories is quite low (D'haenens, et al., 2004; Tewksbury, 2003). Interestingly, the data for topical news exposure shows that the high education group's international news exposure took up as much as 22%¹⁹ of their total news exposure time. This proportion is significantly higher than the low education group's (about 12%), $t(121) = 4.04, p = .001$. At the same time, it is noteworthy that the proportion of total public affairs news exposure, including international news, was not statistically different across the two education groups. Given the relatively small news hole dedicated to coverage of international news in the experimental stimuli as well as in news media generally, it is possible that participants in the high education group might have read more international news stories than they usually do. Indeed, it might very well be that their pre-exposure to political or national affairs made those stories less attractive to read during the experiment. For the same reason, it is possible that more educated participants chose to read more entertainment news stories during the experiment than they normally would.

Conservative bias of the selected newspaper. As described in the method chapter, *The Chosun Ilbo* newspaper (and its online version) used as experimental stimuli has the largest nationwide readership in South Korea. Thus, the news service is influential to a large section of the population. *The Chosun Ilbo* is also well known as a conservative newspaper in Korean society. People with a liberal political orientation are less likely to have favorable views of the paper and therefore also less likely to use this source. Younger generations, who are generally more liberal than older folks, can be expected to have less favorable views of this news outlet. Given the generation gap between the two education groups, it is likely that participants in the

¹⁹ This proportion is relatively high compared to the high education group's exposure to other public affairs news topics (10% for politics, 1.8% for local news, and 12% for leading or breaking news). National news, however, did make up a substantial (22%) portion of their exposure time.

high education group, whose average age are lower than the low education group's, might have avoided some news stories with a conservative bent. This might be particularly true for political news stories.

From close examination of the data on topical exposure, it becomes clear that the high education group's political news exposure (10%) was significantly less than the low education group's (19%), $t(73.88) = 3.56, p = .001$, despite the similarity in the amount of overall public affairs news exposure across the two groups. If a liberally oriented newspaper was used as the experimental stimuli, participants in the high education group might have read more political news than they did with *The Chosun Ilbo*.

Medium effect. As predicted, participants spent more time with public affairs news using a newspaper than an online news source. This result is in line with findings of past empirical research (Dozier & Rice, 1984; Fico, et al., 1987; Heeter, et al., 1989; Tewksbury & Althaus, 2000). Less educated people read more entertainment news stories from the Web-based news outlet than from the newspaper, consistent with the prediction. On the other hand, the interaction effect for education and presentation mode on public affairs news exposure was not significant. The high education group favored the newspaper over the online source for public affairs news exposure as much as the low education group. These findings support a strong medium effect on audience (both education groups) news exposure. Specifically, media users tend to read more public affairs news and less entertainment news²⁰ from newspaper than Web-based news sources, regardless of their education level. It is noteworthy, however, that similar news

²⁰ Even though no hypothesis was formulated regarding the high education group's entertainment news exposure, the data shows that they exposed themselves to more entertainment news using the online ($M = 29.53, SE = 2.30$) than print news source ($M = 18.13, SE = 2.30$) after controlling for the covariates, $F(1, 66) = 11.77, p = .001, \eta^2 = .15$.

exposure patterns across different education groups do not necessarily lead to similar levels of knowledge acquisition (see the discussion for knowledge acquisition below).

Behavioral vs. self-report measures. In addition to the behavioral measure of news exposure used for hypotheses testing, self-reported news exposure data were collected and compared to the behavioral exposure measure. There was a significant difference in the exposure proportions of public affairs and entertainment news across behavioral and self-report measures. Overall, participants overestimated entertainment news exposure by approximately 10% and underestimated public affairs news exposure by the same proportion. The error rate of self-reported news exposure was considerably higher among newspaper readers than online news users. Interestingly there was no significant difference between the two education groups. Yet, the interaction effect of education and presentation mode on the error rate was nearly significant. Specifically, newspaper readers in the low education group underreported public affairs news exposure about three times (13.4%) more than online news users (4.2%) did. On the other hand, more educated people showed a similar error rate in self-reported exposure proportions across the print (9.3%) and the online news group (10.2%). Based on these findings, it can be inferred that newspaper readers, particularly less educated ones, might be exposed to public affairs news more than they are aware of, compared to online news users.

Knowledge Acquisition

The effects of independent factors on participant knowledge acquisition were examined through 5 hypotheses. Hypothesis 1 anticipated a main effect for audience education, predicting that more educated participants would have higher levels of knowledge acquisition than less educated participants. Hypothesis 2b predicted that the low education group would acquire more entertainment than public affairs knowledge and also that this group would gain less public affairs information than the high education group. The forecast of hypothesis 3b was for more

public affairs knowledge gain associated with newspaper than online news use. Hypothesis 4b predicted a presentation mode effect on the low education group's entertainment knowledge acquisition. This group was expected to acquire more entertainment knowledge from the online news outlet than the newspaper version. Hypothesis 6c proposed an interaction effect of audience education and presentation mode, such that less educated people would gain less public affairs knowledge from an online than newspaper source and that more educated people would acquire similar amounts of public affairs knowledge across the two media. These hypotheses were tested through three separate measures of knowledge acquisition: free recall, comprehension, and recognition of story exposure. Hence, findings will be summarized and interpreted for each knowledge acquisition measure.

Free recall. As predicted, more educated participants overall recalled a higher number of news stories from news media use. They also recalled more public affairs news than the less educated group. Participants in the low education group, however, recalled more public affairs than entertainment news stories, contrary to the prediction. Thus, the influence of audience education on free recall of news stories was partially in line with the predictions. The main effects for presentation mode on free recall were significant. Overall, newspaper readers recalled more public affairs news than online news users. In addition, the low education group recalled more entertainment news stories from online news use than newspaper reading. However, there was no significant interaction effect for education and presentation mode on public affairs news recall. As predicted, newspaper readers in the low education group recalled more public affairs news stories than low education online news users, while the high education group did not vary across media on public affairs news recall. Yet, education groups recalled statistically similar numbers of stories from print and online news.

Of the findings, perhaps most relevant to understanding knowledge gaps is that participants in the high education group performed better on news recall than the low education group, despite the same amount of exposure to news across these groups. Another key finding is that the high education group recalled significantly more public affairs news than the low education group, despite slightly less exposure to public affairs news than the low education group. These findings show the strong influence of audience education on recall of news stories beyond the effects of news exposure. In sum, the high education group's superior performance on news story recall, particularly for public affairs news, is consistent with what past knowledge gap research has found.

The finding that the low education group recalled more public affairs than entertainment news, contrary to the prediction, could be attributed to their higher level of exposure to public affairs than entertainment news. A possible explanation for the findings for medium effects on audience news recall is also news exposure differences across the two media groups. As discussed earlier in the "News exposure" section, participants read more public affairs and less entertainment news stories in the newspaper than online condition, regardless of their education level. In other words, news exposure patterns to the two media did not vary significantly across the two education levels. Thus, these exposure differences across the two media groups and no significant differences across the two education groups might have resulted in the following three findings: (1) better public affairs news recall among newspaper readers than online news users; (2) better public affairs than entertainment news recall among less educated participants; (3) better entertainment news recall from online than newspaper use for the low education group.

To test the effects of news exposure on the relationships among audience education, presentation mode, and free recall, ANCOVA tests were conducted with news exposure as a covariate in addition to the six covariates used in hypotheses testing. Further analyses confirmed

that the main effect for participant education on free recall was significant after controlling for news exposure as well as the six covariates, both for public affairs news, $F(1, 110) = 15.49, p = .001$, partial $\eta^2 = .12$, and for entertainment news, $F(1, 102) = 3.44, p = .07$, partial $\eta^2 = .03$. In other words, the high education group recalled more public affairs and entertainment news than the low education group, regardless of news exposure levels. Results from the additional analyses also show that the influence of media presentation mode reduced to below a significant level when news exposure was inserted into the model as a covariate with other ones, $F(1, 110) = 2.33, p = .13$, partial $\eta^2 = .02$ for public affairs news, and $F(1, 102) = .13, p = .72$, partial $\eta^2 = .00$ for entertainment news. It is also noteworthy that public affairs news exposure failed to produce a significant effect on public affairs news recall, $F(1, 110) = .81, p = .37$, partial $\eta^2 = .01$ from the ANCOVA test, while entertainment news exposure significantly affected entertainment news recall, $F(1, 102) = 43.67, p = .001$, partial $\eta^2 = .30$. Thus, participant recall of public affairs news was more dependent on education level than exposure to public affairs news. On the other hand, recall of entertainment news was significantly affected by news exposure. A partial correlation test confirmed that the longer participants spent with entertainment news the more entertainment news stories they recalled, $r = .55, p = .001$. These results offer further support for the idea that more educated people acquire more knowledge from news media use, particularly public affairs knowledge, than less educated people, irrespective of their exposure time to public affairs news and the type of news media they use.

Comprehension. In line with the prediction, more educated participants attained higher comprehension scores, overall, than less educated participants. Comprehension of public affairs news was also better among higher than lower education groups. Yet, it is noteworthy that the low education group showed better comprehension for public affairs than entertainment news, which is contrary to the prediction. Hence, the effects for audience education on news comprehension were only partially consistent with the predictions. On the other hand, the effects

for presentation mode on news comprehension were in line with the predictions. Specifically, the newspaper group achieved higher comprehension scores for public affairs news than the online news group, and online news users in the low education group comprehended entertainment news better than the low education newspaper group—yet not at statistically significant levels. The interaction effect for education and presentation mode on participant comprehension of public affairs news was also significant. Specifically, less educated people showed better comprehension for public affairs news using a newspaper than online source while more educated people showed a similar level of comprehension across the two media, as predicted. In sum, with the exception of one prediction (that the low education group will have better comprehension of entertainment than public affairs news) all hypotheses for the effects of audience education and news medium on comprehension were supported. It is particularly noteworthy that the interaction effect for audience education and presentation mode was in line with the prediction, unlike the results for the free recall measure.

The significant interaction effect for education and medium on participant comprehension of news implies that less educated people's understanding of public affairs news varies across the media from which they acquire information whereas more educated people's comprehension is unaffected by the type of medium. A further analysis provides additional support for this conclusion. An ANCOVA test, which included public affairs news exposure as an additional covariate with the other six, showed that the interaction effect was still significant after controlling for the effect of exposure, $F(1, 112) = 20.68, p = .001$, partial $\eta^2 = .16$. The ANCOVA test also revealed that newspaper readers' comprehension of public affairs news ($M = 5.23, SE = .13$) was better than online news users ($M = 4.78, SE = .13$) after controlling for the amount of public affairs news exposure, $F(1, 112) = 5.55, p = .02$, partial $\eta^2 = .05$.

Interestingly, the influence of news exposure had more dramatic impact on entertainment than public affairs news comprehension. An ANCOVA test with 7 covariates (i.e., entertainment news exposure plus the six covariates of this study) showed that neither a main effect for education or medium nor an interaction effect between education and medium was significant on entertainment news comprehension. Except for participant age, entertainment news exposure was the only factor significantly associated with comprehension of entertainment news, $F(1, 102) = 20.73, p = .001$, partial $\eta^2 = .17$. Partial correlation tests confirmed that the younger the participants, the better their comprehension of entertainment news, $pr = -.20, p = .04$. Moreover, as the exposure time to entertainment news increased, comprehension improved, $pr = .41, p = .001$. Thus, a possible explanation for the lower education group's poor comprehension of entertainment compared to public affairs news might be driven by the amount of exposure to the two types of news content. Indeed, 20% of the low education group's total exposure time was focused on entertainment news, while public affairs took up 80% of their exposure time during the experiment.

In summary, the comprehension measure offered strong support for the hypotheses of this study. Moreover, the one unsupported prediction can be explained by examining the influence of exposure time on comprehension. Overall, supported predictions for the comprehension measure might have important theoretical implications. As discussed earlier, comprehending news stories requires more than remembering individual news stories. The comprehension measure assesses the depth of understanding news stories, while the free recall measure examined the amount of information remembered from news media use. Hence, the findings for the comprehension measure, particularly the interaction effect of education and presentation mode, support the main thesis of this study that the knowledge (public affairs in particular) gap between high and low education groups might be widening with online news use more so than with newspaper reading.

Recognition of story exposure. Contrary to the prediction, participants in the high education group did not recognize more news stories, overall, than the low education group. Moreover, the high education group's recognition of public affairs news was not statistically different from the less educated group. Also counter to what was expected, the lower education group achieved higher scores for public affairs than entertainment news recognition. In sum, the effects for audience education on recognition of news stories were not consistent with the predictions. Yet, the effects for presentation mode on recognition were in line with the predictions. Participants in the newspaper group recognized more public affairs news than those in the online news group. In addition, news users in the low education group recognized more entertainment news using the online than newspaper source, yet not at statistically significant levels. On the other hand, the interaction effect for education and presentation mode on public affairs news recognition was not significant. Less educated participants recognized a smaller number of public affairs news stories from online than newspaper use, as predicted. Similarly, but counter to the prediction, the high education group also recognized fewer online than newspaper stories. Thus, of the predicted effects for education and presentation mode on recognition of news stories, only presentation mode produced significant findings.

It is noteworthy that the high education group did not outperform the low education group in the recognition of public affairs news specifically or news stories overall. To parse out the influence of news exposure on education and news recognition, ANCOVA tests with news exposure as a covariate in addition to the other six were conducted. Results show that the main effect for education on news recognition remained non-significant for both public affairs, $F(1, 111) = .02, p = .88, \text{partial } \eta^2 = .00$, and entertainment news, $F(1, 110) = .16, p = .69, \text{partial } \eta^2 = .00$, after controlling for seven covariates. These results are not consistent with the findings from the other two measures of knowledge acquisition. As shown earlier, more educated participants recalled more news stories (including public affairs news) and showed better comprehension for

those news stories they recalled than the less educated group. Furthermore, the high education group's better performance for public affairs news recall and comprehension was beyond the influence of the amount of news exposure.

A possible explanation for the unexpected small effects for education on news recognition, particularly for public affairs news, might be the strong influence of presentation mode on news recognition. The results of further analyses with seven covariates show that the effect for presentation mode on public affairs news recognition remained powerful after controlling for the amount of news exposure. In fact, the newspaper group's recognition of public affairs news ($M = 20.03$, $SE = 1.16$) was significantly better than the online news group ($M = 11.13$, $SE = 1.09$), $F(1, 111) = 30.29$, $p = .001$, partial $\eta^2 = .21$. Furthermore, public affairs news exposure was not significantly associated with the recognition of public affairs news, $F(1, 111) = 2.43$, $p = .12$, partial $\eta^2 = .02$. In contrast, presentation mode did not affect entertainment news recognition, either by including or excluding entertainment news exposure as a covariate in statistical tests. Among the nine independent factors (education, presentation mode, and 7 covariates), entertainment news exposure was the only factor which had a significant relationship with entertainment news recognition, $F(1, 110) = 48.16$, $p = .001$, partial $\eta^2 = .30$. A partial correlation test confirmed that the more participants read entertainment news stories the better their recognition of entertainment news, $pr = .55$, $p = .001$. These findings seem to support the strong medium effect on public affairs news recognition beyond news exposure and the strong exposure effect on entertainment news recognition beyond audience education and news media type. Findings for the recognition measure, however, require careful interpretations, for several reasons.

Unlike the free recall measure, it was more complicated to assess whether recognition for each news story was correct or false, particularly with the newspaper group. The log files for

the online news condition provided exact data on which stories each participant read as well as exposure time to each news story that was read. On the other hand, the observation method employed for the newspaper condition could only offer the exposure time per page. Thus, it was technically impossible to identify which news articles participants actually read on any given page. Further analyses of the data for the online news group only (after separating wrongly recognized news stories from correctly recognized ones) show that the average proportion of false recognition for the online news group was 22% for public affairs news and 19% for entertainment news. More importantly, this error rate was different across the two education groups in the online condition. Specifically, less educated people showed a higher rate of false recognition for both public affairs, $F(1, 60) = 16.89, p = .001, \text{partial } \eta^2 = .22$, and entertainment news, $F(1, 60) = 5.61, p = .02, \text{partial } \eta^2 = .09$, than more educated participants. Furthermore, the online low education group's false recognition was higher for public affairs (35%) than entertainment news (28%), whereas the online high education group did not show a considerable difference (13% and 12% respectively). These findings might be due to less educated participants' more limited cognitive ability for correct recognition. It is also possible that higher social desirability bias, among the lower than higher education group, might have influenced their responses to the recognition measure. Generally speaking, media users' over-reporting of news story exposure (i.e. socially desirable report) is more closely related to public affairs, which are socially important issues, than entertainment news. Indeed, it seems that lower educated participants were eager to say that they remembered reading public affairs news. Their incorrect exposure recognition was higher than the high education group's overall and also higher for public affairs than entertainment news stories.

For a more reliable examination of participant recognition scores, the more exact data for the online news group (i.e., correct recognition, not reported recognition) were analyzed through ANCOVA tests with the six covariates. Results show that neither public affairs nor

entertainment news recognition was different across the two education groups, $F(1, 54) = .57, p = .50$, partial $\eta^2 = .01$, and $F(1, 54) = .24, p = .63$, partial $\eta^2 = .00$ respectively, similar to the results of the reported recognition for all participants. Further analyses were conducted, adding news exposure as a covariate. Yet, controlling for exposure did not change the outcome of the education effect. News exposure, however, did show significant associations with both public affairs, $F(1, 53) = 4.43, p = .04$, partial $\eta^2 = .08$, and entertainment recognition, $F(1, 53) = 13.97, p = .001$, partial $\eta^2 = .21$. Partial correlation tests revealed a positive association between recognition scores and news exposure across public affairs, $pr = .28, p = .04$, and entertainment news, $pr = .46, p = .001$. Considering that participants were randomly assigned to the two media groups, these findings might, with caution, be generalized to the newspaper group. That is, recognition of news stories is dependent on the amount of news story exposure, regardless of education level. It is at this point not possible to be sure that the exposure effect would emerge when presentation mode is included in the model. The technical difficulty in identifying correct recognition for the newspaper group prevents certainty.

Implications of Findings

Presentation Mode

This study found strong effects for medium (newspaper vs. online news) on user news exposure and knowledge acquisition. Specifically, participants spent significantly more time with public affairs news when they used the print than online news source. Accordingly, they acquired a larger amount of public affairs information (free recall measure), showed better comprehension on such information (comprehension measure), and recognized a greater number of public affairs news stories (recognition of story exposure measure) reading the newspaper compared to using the online news site. The effects for presentation mode on media user knowledge acquisition, particularly public affairs knowledge, were remarkably stable across comprehension and

recognition measures. Participants in the newspaper condition showed better comprehension and recognition of public affairs news than those in the online news condition even after statistically controlling for the amount of public affairs news exposure. On the other hand, the influence of media presentation mode on public affairs news recall reduced to below a significant level when news exposure was included in the analysis as a covariate. It is also noteworthy that the low education newspaper group underestimated their public affairs news exposure more than any other experimental group (i.e., high education newspaper, high education online, and low education online), in that the largest difference between behavioral and self-reported news exposure was associated with this group. That is, compared to more educated people, the less educated were more exposed to public affairs news using a newspaper than an online news source without being aware of it.

All these findings seem to support past empirical research that pointed to traditional print media as more effective than new media in facilitating the process of learning public affairs information (see Eveland, 2003; Eveland & Dunwoody, 2002; Eveland, et al., 2002 for reviews). As discussed in the literature review chapter, online news formats are featured with fewer editorial story importance cues than newspapers, which were expected to influence audience news selection and exposure. Specifically, online news users who typically have more control over news story selection are less likely to be accidentally exposed to public affairs news than they would be, reading newspapers. According to Iyengar and Kinder (1987), less educated people are particularly vulnerable to formal salience cues supplied by media because they have limited prior knowledge of public affairs that can be used in judging news story importance. Findings of this study are in line with this argument. Indeed, results from comparisons between behavioral and self-reported news exposure measures showed participants overall underreported their exposure to public affairs news and this underestimation was most prominent with newspaper readers in the low education group. This means that less educated people might be

exposed to more public affairs news in newspapers than they consciously recognized perhaps because they were guided by editorial cues to a greater degree than those in other experimental conditions.

Most important, print media's superiority in facilitating the process of learning public affairs information is revealed in the robust findings for presentation mode on audience comprehension and recognition of public affairs news beyond the influence of the news exposure amount. Of the three knowledge acquisition measures, free recall is perhaps most strongly influenced by the exposure amount because it assesses how much information was obtained from news media use. As discussed earlier, the structural features of the newspaper might have encouraged its readers to choose more public affairs news stories than they would do using an online news source. Thus, newspaper readers' significant higher scores on free recall of public affairs news might be primarily driven by exposure differences between the two media groups. Interestingly, comprehension and recognition of public affairs news was not significantly influenced by the amount of news exposure. In fact, newspaper readers outperformed online news users on comprehending and recognizing public affairs news, after controlling for the effect of news exposure. Intuitively, the number of news stories recognized, similar to news stories recalled, seems to be more closely related to news exposure time than media type. One possible explanation for such a strong medium effect is the structural features of newspapers. As described earlier in the literature review, newspaper readers explore the newspaper to find news stories of interests through linear page-by-page scanning of headlines. By doing so, they are likely to be exposed to news stories (at least their headlines) which they might not be interested in, particularly if those stories are placed on the front page or the first section (Althaus & Tewksbury, 2002; Heeter, et al., 1989).

It is noteworthy that some recent empirical studies on learning from news media have found that online news (with links to related stories) is more beneficial for acquiring in-depth structured knowledge than print media (or online news without links) (e.g., Dalrymple & Scheufele, 2007; Eveland, Marton, et al., 2004; Eveland, et al., 2002). This is inconsistent with findings of the current study that identified the newspaper group as superior in comprehension of public affairs news compared to the online news group. One prominent methodological difference between this study and past research is the measurement index for in-depth understanding. Indeed, the comprehension measure employed in this dissertation examined whether news media users understand the main point of news stories they read, whereas the knowledge structure density scale used in previous studies assessed respondents' ability to understand the interconnectedness of related concepts. Clearly, the focus of measurement varies considerably across this study and past research. It might therefore be an oversimplification to conclude that empirical evidence for in-depth understanding across online and print news is mixed. It is notable, however, that the comprehension of public affairs news among the high education group was close to significantly higher for online than newspaper readers, whereas for the low education group the two media group means were in the opposite direction and significantly different. This finding suggests that the online news format might be particularly beneficial for those who have higher levels of education to acquire in-depth knowledge about public affairs.

Audience Education

In line with predictions, the findings of this study support a strong audience education effect on public affairs knowledge acquisition, at least in terms of factual knowledge (i.e., free recall). It is notable that more educated people recalled a larger amount of public affairs news stories than the less educated, despite no statistical difference in news exposure across the two

education groups. This finding sheds light on a nagging issue within knowledge gap research. Put simply, citizens who have completed higher levels of education generally obtain more public affairs information from news media than lower education groups not because they are exposed more to news media, but because they are cognitively better equipped to absorb information. As stated in the literature review, highly educated people, who are typically more knowledgeable on a variety of topics including public affairs (Price & Zaller, 1993; Tichenor, et al., 1970), have well-organized long-term memory schemas. Moreover, high levels of education are also closely related to elaborated and efficient information processing skills (Ceci, 1991; Cho & McLeod, 2007; Eveland & Scheufele, 2000; Grabe, et al., 2000; Jerit, et al., 2006; D. M. McLeod & Perse, 1994; Price & Czilli, 1996; Wade & Schramm, 1969).

Interestingly, the amount of public affairs news exposure was not significantly associated with the number of recalled news stories. This finding coupled with the strong education effect on knowledge gain offers new insights that must be considered in the debate about the causal relationship between prior knowledge and communication (mainly in mediated form). It might seem apparent that the majority of political and public affairs information that people acquire originates from communication channels (mass media and interpersonal communication) (Delli Carpini & Keeter, 1996; Eveland, et al., 2005), yet there is considerable disagreement among political communication researchers about the causal direction in the process of knowledge gain (see Eveland, et al., 2005; Price & Zaller, 1993 for reviews). Some theorists (e.g., Luskin, 1990; Neuman, 1986; Price & Zaller, 1993) argue that people who have a lot of political knowledge are more likely to be interested in political affairs, which in turn encourages them to pursue additional political information from various sources. Other scholars (e.g., Eveland, et al., 2005) insist on the primacy of communication, not prior knowledge, in driving knowledge gain by reporting evidence for a unidirectional causal model from communication to knowledge gain. Both camps though seem to acknowledge the potential of reciprocal (or circular) relationships

between prior knowledge and knowledge acquisition, as many other scholars do (e.g., Atkin, Galloway, & Nayman, 1976). Although the findings of this dissertation do not offer evidence to resolve this debate, there are strong indications that prior knowledge (i.e., formal education level) is a stronger predictor of public affairs knowledge acquisition than the amount of news consumed. In fact, the role of background knowledge in gaining new public affairs information is indirectly revealed in comparison with entertainment information acquisition. Unlike public affairs information, entertainment knowledge acquisition—which arguably does not depend on high levels of prior knowledge for effective information processing—was strongly influenced by the amount of exposure, across all three measures (free recall, comprehension, and recognition). Moreover, neither the medium nor the education factor was significantly associated with entertainment knowledge acquisition.

Interaction of Medium and Education: Evidence of the Digital Divide

Considering the primary purpose of the current study, to empirically investigate the potentially widening knowledge gap associated with online news use compared to traditional newspaper use, the most meaningful finding might be that knowledge gain, particularly in terms of comprehension, varied most prominently between the high and the low education groups in the online news condition. The significant interaction effect between education and medium on the comprehension measure, not on free recall or recognition, prompts practical as well as theoretical consideration. Indeed, a number of researchers (e.g., Bonfadelli, 2002; Dervin, 1980; Woodall, et al., 1983) complained about poor conceptualization and operationalization of “knowledge” in knowledge gap research—perhaps with good reason. Many empirical studies measured knowledge acquisition using simple issue awareness or discrete factual information retention assessments rather than measuring in-depth understanding of topical issues. It is notable that in the research area of “learning from media,” a number of scholars have

conceptually distinguished understanding news content from remembering it (Gaziano, 1983; Ortony, 1978; Robinson & Levy, 1986; Snoeijer, et al., 2002; Woodall, et al., 1983). If memory measures such as recall and recognition examine how much information is acquired from news stories, the comprehension measure assesses whether respondents are able to meaningfully integrate factual information into existing knowledge structures (Tremayne & Dunwoody, 2001). Thus, the significant interaction between education and presentation mode on the comprehension of public affairs news suggests that emerging news media might exacerbate the existing education-based gap on meaningful understanding of socially important issues.

Indeed, findings of this study show that the interaction effect for education and presentation mode on the comprehension of public affairs news was unaffected by the news exposure amount, just like the main effect for media presentation mode (see above). This means that the information gap associated with online news might intensify as the reliance on new media as information sources increases. So far, the majority of news media users still lean on traditional news media as their primary news sources and use online news formats as complementary (see Ahlers, 2006; Althaus & Tewksbury, 2000; Gilens, Vavreck, & Cohen, 2007; Tewksbury, 2006). The migration to online sources is likely to continue in the future while audience news consumption of old media formats can be expected to decline. In conclusion, the findings of this study, particularly the larger knowledge gap among online news users in terms of news understanding, offer empirical evidence for the digital divide phenomenon.

Multiple Measures of Knowledge Acquisition and News Exposure

This study used multiple measures for two dependent variables: knowledge acquisition and news exposure. Employing multiple measures for a single variable and drawing comparisons among them were not often done in past research—neither for knowledge acquisition nor for news exposure (news media use in general). Three distinct measures of knowledge acquisition

(free recall, comprehension, and recognition) were adopted not only for thorough examination of memory but also because different memory measures test different dimensions or sub-processes of information processing (Craik & Lockhart, 1972; Lang, 2000; Shoemaker, et al., 1989; Tulving & Thompson, 1973). Recognition is used for assessing encoding while free recall tests are employed for examining retrieval processes (Lang, 2000). As discussed earlier, comprehension involves integrating factual information into prior knowledge beyond memory for discrete information (Tremayne & Dunwoody, 2001). Behavioral assessments of exposure are more objective and less obtrusive than self-reports. Therefore, exposure behavior was used as the primary measure for hypothesis testing, while self-reported news exposure was measured for the purpose of comparisons with the behavioral measure.

Overall the three different measures of knowledge acquisition provide compelling evidence of knowledge gaps and digital divides: highest performance by the high education group, better learning outcomes among newspaper readers, and widening knowledge gaps in the online news condition. Yet, different knowledge acquisition measures delivered dissimilar findings, as discussed earlier in this chapter. Specifically, findings for free recall support strong education effects; results associated with the recognition measure are in line with strong medium effects. For the comprehension measure, strong medium effects were found as well as a significant interaction effect between medium and education. Based on these findings, the following inferences can be made: Newspapers enable readers to encode more information compared to the online news format; high levels of education are associated with high levels of information retrieval; news media users comprehend the same information better in print than online versions of news media. Different results from different measures of knowledge acquisition suggest that conceptualization and operationalization of knowledge (and knowledge acquisition) might be a critical issue in understanding how citizens learn from news media.

Comparisons of behavioral and self-reported news exposure measures also reveal considerable differences. First, participants tended to underreport public affairs news exposure and over-report entertainment news exposure. The measurement error is particularly problematic when the bias is unevenly distributed across groups. Indeed, participant underestimation of public affairs news exposure (i.e., overestimation of entertainment news exposure) was prominent in the newspaper group, among low education participants. The high education group's error rate was similar across newspaper and online news conditions while the low education online news group showed the highest accuracy among the four experimental groups. What seems clear from these findings is that less educated people are not always poor assessors of their own behavior. Perhaps more important is the conclusion that self-report measures do not appear to be reliable, as a number of scholars (Bechtel, et al., 1972; Curtain, et al., 2007; Knobloch-Westerwick, Carpentier, et al., 2005; Martinelli & Chaffee, 1995; Papper, et al., 2004; Price & Zaller, 1993; Steiner, 1966; Tewksbury, 2003, 2006) have already pointed out. Self-report measures are popular in research because of convenience in administration, low cost, and time efficiency. Yet, this way of collecting data does not belong on a "best research practices" list.

Limitations of the Study and Suggestions for Future Research

The findings of this study produced evidence that supports the main thesis of a widening information gap between high and low education groups, driven more so by new media than traditional print media use. There are, however, limitations to be considered in interpreting the findings of this study and, more importantly, these insights might benefit future research.

The professionally produced online news site used in this study increased external validity. Yet, a couple of typical features associated with the online news format, such as search functions and links to related news stories, were eliminated when producing the experimental

site. This was done primarily to achieve balance in the informational volume between online and print versions of stimuli. Empirical research on learning from hypermedia systems, however, has found that such unique traits of online news, particularly the number of links, significantly affect navigational problems (i.e., enhance disorientation) and learning outcomes (e.g., Eveland & Dunwoody, 2001b; 2002; McDonald & Stevenson, 1996; see also DeStefano & LeFerve, 2007 for a review). Even though equality in content volume across experimental stimuli contributes to preserving internal validity, more realistic experimental stimuli that include media-specific features might make generalizations of research findings to real-life situations (i.e., ecological validity) more reliable. As Eveland et al. (2004) stated, content difference across media “seems to be the least theoretically interesting difference that one might choose to study” (p. 84). Thus, future research should include basic functions—not necessarily identical to the original sites—in experimental websites.

As discussed in a previous section called, “Summary and interpretations of findings,” there was a considerable generation gap between the two education groups, which might have affected participant news exposure behavior, beyond post-hoc statistical controls. In addition to news exposure, participant age is likely to affect important factors, related to knowledge acquisition. Young adults are cognitively more competent than older adults (Dixon, Simon, Nowak, & Hultsch, 1982; Wheeler, 2000). The gap in cognitive ability due to age might have been confounded with that derived from different levels of education. In other words, more educated participants might have outperformed less educated participants in news recall and comprehension tests at least partially because of their age. Some amount of variance was probably not accounted for in post-hoc statistical procedures. Therefore, in future empirical research participants from different education groups should be recruited from similar age groups for more rigorous comparisons.

Knowledge acquisition measures might be biased in favor of those with higher levels of education. According to Findahl and Höijer (1985), recall measures play on the strengths of more educated participants who typically have better writing skills and perhaps better command of verbal skills to express ideas. It is noteworthy that for the recognition measure, presented with multiple cues to activate memory (i.e., news story headlines for this study), there was not a statistically significant difference between the two education groups, whereas strong education effects were found for the free recall measure. Although the lack of an education-based difference on the recognition measure is primarily attributable to strong medium effects (print media's superiority) as discussed earlier, the possibility that recognition measures are more beneficial to low education group memory assessments than recall measures cannot be excluded. Therefore, it is important for future researchers to take care in choosing knowledge acquisition measures when participant education level is an independent variable of interest.

In addition to the recommendations related to the limitations of this study, a couple of other suggestions are offered for future research. First, it would be meaningful to investigate the impact of individual level factors such as general political interest on knowledge gaps driven by new media. Indeed, a considerable proportion of past knowledge gap research focused on individual differences instead of social structural factors (see Gaziano, 1983, 1997; Viswanath & Finnegan, 1996 for reviews). Moreover, some researchers (e.g., Prior, 2005; Sunstein, 2001) have posited that motivation (including interest or involvement) is particularly important in new media environments because greater range in choices created by new ICTs encourages media users to choose information matching their preferences. If differences in news exposure and knowledge acquisition are found across people who vary in political interest but who are at the same time rather homogeneous on demographic attributes (e.g., age, education), further evidence of audience fragmentation driven by new media would be at hand.

The content diversity in news media also deserves consideration in future research. New media's overwhelming supply of information volume and diversity can be expected to widen information gaps, as stated in the introduction. Quite a few researchers (Curtain, et al., 2007; Jerit, et al., 2006; Knobloch-Westerwick, Carpentier, et al., 2005; Prior, 2005; Sunstein, 2001) have asserted that wider selection of content and informational channels created by new communication technologies would facilitate audience divisions. Specifically, content diversity can be manipulated in varying degrees as an independent variable to assess if this might be a determining factor in new media driven knowledge gaps.

As stated in the introduction chapter, the original team of knowledge gap researchers (Tichenor, et al., 1970) proposed two distinct methods of testing the hypothesis. First, as a longitudinal pursuit, differences in knowledge acquisition between high and low education groups are measured over two time points. A larger difference at the second point supports the hypothesis. Second, as a cross-sectional method, education-based knowledge gaps are compared across topics with different levels of media publicity. A larger difference in knowledge gain from topics with higher publicity is taken as support for the hypothesis. Knowledge acquisition from old and new media can also be tested with the two methods. For example, if the difference in information gain among media users across old and new media conditions increases over time, it can be inferred that new media use is less beneficial in learning than old media. In the same manner, more information acquisition from traditional than new media use for more salient news topics also implies old media's superiority for learning.

Lastly, it is important to replicate the research design and operationalization of main variables in other cultural settings. Data collection for the current study was conducted in South Korea. This country is quite homogenous in terms of ethnicity, language, and education levels compared to other countries. Moreover, South Korea is a leading country in terms of the

penetration of new ICTs, particularly the Internet. Thus, one can expect some findings to be different if the same study is conducted in other countries with different cultural markers.

In conclusion, this dissertation offers evidence of traditional media's superiority in facilitating learning, at least in the context of informal learning from news media, and widening information gaps across different education groups from new media use compared to traditional media use. It is important to note that the relatively low benefit of online news for informed citizenship (compared to print news) does not mean null effects for online news. Indeed, participants in this study acquired a considerable amount of information from online news use, despite lower levels of information acquisition than from newspaper use. Undoubtedly online news facilitates user learning about socially important public affairs. Again, this is particularly true for citizens at higher levels of the social hierarchy. This dissertation therefore offers a sobering reminder of the digital divide. What was reported here stands in sharp contrast to the rather naïve perspective, advocated by some technological optimists, that new ICTs would narrow information disparity through easy accessibility, diverse and abundant content, user-friendliness, and decreasing cost. The noble ideals of democratic theory emphasize an equally informed citizenry over how well informed citizens are overall. The information explosion due to new technologies theoretically rises the level at which citizens can become knowledgeable. But it does so, with bias against citizens in lower socioeconomic strata. In this sense this dissertation calls on researchers, media practitioners, and policy makers to monitor information gaps as the pervasiveness of new media in society increases.

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Appendix A: Disorientation Measures for Newspaper and Online News Conditions

<Newspaper>

Please indicate how much you agree or disagree with each of the following statements by checking a number from 1 (strongly disagree) to 5 (strongly agree), to identify how you felt while you were reading the paper.

I could easily find my way to the information I wanted to see (reverse).

Strongly disagree 1 2 3 4 5 Strongly agree

Sometimes I got “lost” in the newspaper pages.

Strongly disagree 1 2 3 4 5 Strongly agree

I found it easy to navigate the newspaper (reverse).

Strongly disagree 1 2 3 4 5 Strongly agree

The newspaper was organized in a clear manner (reverse).

Strongly disagree 1 2 3 4 5 Strongly agree

It took me a while before I was able to figure out how the newspaper was organized.

Strongly disagree 1 2 3 4 5 Strongly agree

<Online news>

Please indicate how much you agree or disagree with each of the following statements by checking a number from 1 (strongly disagree) to 5 (strongly agree), to identify how you felt while you were navigating the website.

I could easily find my way to the information I wanted to see (reverse).

Strongly disagree 1 2 3 4 5 Strongly agree

Sometimes I got “lost” in the Web site.

Strongly disagree 1 2 3 4 5 Strongly agree

I found it easy to navigate through the site (reverse).

Strongly disagree 1 2 3 4 5 Strongly agree

The site was organized in a clear manner (reverse).

Strongly disagree 1 2 3 4 5 Strongly agree

It took me a while before I was able to figure out how the Web site was organized.

Strongly disagree 1 2 3 4 5 Strongly agree

Appendix B: Log Sheet of Newspaper Exposure

Participant ID _____

Coder ID _____

Order	Starting time		Page number
	Minute	Second	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Order	Starting time		Page number
	Minute	Second	
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Appendix C: Self-Report of News Exposure

Please write down the approximate percentage of time you spent with each of the following news topics during your participation here today. There is space provided next to each news category. Please make sure that the percentages add up to 100%.

- What percentage of time did you spend on reading **political** news? _____%
- What percentage of time did you spend on reading **international** news? _____%
- What percentage of time did you spend on reading **national and regional** news? _____%
- What percentage of time did you spend on reading news about **culture and people**? _____%
- What percentage of time did you spend on reading **sports** news? _____%
- Total 100%

Appendix D: Free Recall

Please describe all the news stories that you remember reading here today in the space below.

Use **5 to 10 words** to describe each story. **Please number each story.** When you have completed this, please let the experimenter know.

Appendix E: Comprehension

Looking back at the stories you listed, please describe details that you remember about each story. Use a separate page for describing each story. **Please match the story numbers with those in the preceding questionnaire.** When you have completed this, please let the experimenter know.

<Story 1>

Note. Participants were given the same number of story description sheets as the number of listed stories in the free recall measure. Numbers of story description sheets were filled out in advance by the experimenter and handed to participants.

Appendix F: Media Use as Covariates

We are interested in how people use media in their everyday lives. Please choose the category that comes closest to describing your media use. For the open ended questions, please write down your estimate in the parentheses.

1. How frequently do you read newspapers?

- (1) Nearly every day
- (2) 3 to 5 days per week
- (3) 1 or 2 days per week
- (4) Once every few week
- (5) Less often
- (6) Never

2. **On days when you read a newspaper**, about how much time do you spend reading it?

() hours () minutes

3. How frequently do you use the Internet?

- (1) Nearly every day
- (2) 3 to 5 days per week
- (3) 1 or 2 days per week
- (4) Once every few weeks
- (5) Less often
- (6) Never

4. **On days when you use the Internet**, about how much time do you spend using it?

() hours () minutes

5. How frequently do you get news on the Internet?

(For example, news services of portal sites such as *Naver* or *Daum*, websites of newspapers such as *Chosun Ilbo* or *DongA Ilbo*, and websites of Internet-based newspapers such as *OhmyNews* or *Pressian*)

- (1) Nearly every day
- (2) 3 to 5 days per week
- (3) 1 or 2 days per week
- (4) Once every few weeks
- (5) Less often
- (6) Never

6. **On days you get news on the Internet**, about how much time do you spend getting news online?

() hours () minutes

7. Have you ever read *The Chosun Ilbo*?

- (1) Yes
- (2) No

8. If yes, how often do you read it?

- (1) Nearly every day
- (2) 3 to 5 days per week
- (3) 1 or 2 days per week
- (4) Once every few weeks
- (5) Less often

9. Have you ever accessed *The Chosun Ilbo* website?

(1) Yes

(2) No

10. If yes, how often do you access it?

(1) Nearly every day

(2) 3 to 5 days per week

(3) 1 or 2 days per week

(4) Once every few weeks

(5) Less often

Appendix G: Participant Parameters

Thank you for responding to our invitation to participate. I have a few questions to ask of you first.

1. Can you tell me your gender and age?

Gender (male, female), () years old

2. How frequently do you read newspapers...would you say nearly every day, 3 to 5 days per week, 1 or 2 days per week, once every few weeks, less often, or never?

- (1) Nearly every day
- (2) 3-5 days per week
- (3) 1 or 2 days per week
- (4) Once every few weeks
- (5) Only a few times
- (6) Never

3. Do you use the Internet?

- (1) Yes
- (2) No

4. If yes, for how long have you used the Internet?

() years () months

5. How frequently do you get news on the Internet...would you say nearly every day, 3 to 5 days per week, 1 or 2 days per week, once every few weeks, less often, or never?

- (1) Nearly every day
- (2) 3-5 days per week
- (3) 1 or 2 days per week
- (4) Once every few weeks
- (5) Less often
- (6) Never

6. What is the highest level of education that you have completed?

- (1) Postgraduate (including current enrollment)
- (2) Graduated from college
- (3) Some college education (including current enrollment)
- (4) High school
- (5) Less than high school

Curriculum Vitae

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Education

Ph.D.	2008	Department of Telecommunications Indiana University, Bloomington
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