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# Does technology make us poor spellers?

The effects of CMC on standard spelling



Linnéa Andersson  
Ämneslärarprogrammet

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Handledare: Miguel Garcia Yeste  
Examinator: Pia Köhlmyr  
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## Abstract

In this digital era, technology has been accused of causing declining language standards. However, not much research has been put forth to support this claim. Therefore, this literature review seeks to examine current studies investigating the impact of Computer Mediated Communication (CMC) on standard spelling. Features of CMC are presented, as well as learning theories relevant for the understanding of the linguistic debate. Moreover, results from research on CMC in formal and informal contexts are addressed, followed by an examination of studies conducted on different educational levels. This review suggests that there are indeed both positive and negative aspects of CMC use, seemingly related to context and age of participants. Issues regarding methodology are discussed, as well as implications for language education. Lastly, suggestions for future research are proposed.

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# 1 Introduction

Few linguistic features arouse emotions the way spelling does. The debate started way back in the Early Modern Period (1500–1700), when the ideology of English standardization started to grow strong. To give the English language as high a status as classic Latin and Greek, the chaotic English spelling should be standardized and variations suppressed. However, since English is a living language in use, and subject to modification, the comparison was deceptive (Horobin, 2013).

Even today, the discussion on appropriate and correct spelling is active and vigorous. It seems like everyone holds an opinion and people merely speaking English seem to entitle themselves experts. Recently, a common enemy, considering the suggested regression in language standards, seems to have been agreed upon; technology (e.g. Humphrys, 2007; Merritt, 2013). By consulting a systematical examination of the media framing of computer-mediated communication (CMC), the results speak loud; CMC is claimed to bring negative effects on standard language (Thurlow, 2006). However, not much evidence in form of research has been put forward to support this accusation. Instead, evaluations on the impact of technology has stopped at a stage where it has simply been “*anecdotal, dismissive, and, sometimes, surprisingly vitriolic*” (Thurlow, 2006, p. 668). Furthermore, when journalists, teachers and opinionated laymen kidnap the discussion, it is vital to consult research in the field.

The goal of this review is twofold. Firstly, it aims to present, as well as problematize, empirical studies examining the relationship between CMC and spelling outcome. Secondly, it seeks to discuss the, sometimes conflicting, results in the presented field, as well as accentuate areas in need of further research.

## 1.1 The digital era

It is not controversial to say that an enormous technological leap has taken place during the last five decades. However, it is also relevant to point out that the idea of modifying nature to allow new ways of communication is not a new phenomenon. Throughout history, inventions facilitating everyday life have been brought forward in the shape of tools and gadgets enabling more effective and efficient ways of communication (Tallvid, 2015). Innovations such as the telegraph, broadcasting, the telephone and the printing press have unquestionably had an enormous impact on human society, and on when, where and how we communicate. However, Crystal (2004) argues that the true game-changer in the field of communication is the Internet. He further emphasizes that not in 10,000 years, when the written word first

emerged, has the whole of society been as prominently affected as it was by the development of online communication. Indeed, the Internet is undeniably the fastest extending communication technology in the world (Matsuda et al, 2003), and even though Thurlow (2003) encouraged people to question the assumptions on the importance of technology in young people's lives, we can today, confidently, say that technology is unquestionably a prominent feature of a young person's everyday life. In 2011, 94 % of people aged 16–24 (in Sweden) reported to use Internet at home on a daily basis (Statistiska Centralbyrån, 2013), and there is no sign of a falling trend.

Not only is technology ever present in people's free time, technological tools and gadgets are gaining ground in the classrooms as well. The process of digitalization in education has been around for over 40 years, however, from the 1990's and onward, the access to digital tools in schools has increased drastically (Tallvid, 2015). Today, technology is a self-evident element of students' school day. Moreover, technology's existence in education is not heavily questioned anymore. The focus has been shifted from *if* technology belongs in schools, to *how* it can be incorporated effectively. Considering the aim of this review, it is relevant to reflect upon technology's role in language teaching, as well as discuss potential problems and possibilities for literacy development in the digital era.

## 1.2 Features of CMC

When examining the relationship between technology and literacy, it is fruitful to look into what kind of written language the modern person is exposed to. The Internet is an extensive source of information and entertainment, with a growing body of material. Today, the web does not only contain texts produced by people owning the webpages, but the Internet is now everybody's arena, and new material is being produced every second (Goddard & Geesin, 2011). Considering the implications of this transition, a large proportion of the written language online is not 'controlled', or revised, to the same extent as, e.g. newspapers and books. This has consequences for what kind of written material is found online and, ultimately, what language is being produced. The focal language of this review is Computer Mediated Communication, which has been accused of being the source of bad spelling and fading language standards, even though solid evidence is seemingly absent.

Computer Mediated Communication (CMC) is an umbrella term used for communication produced with help from electronic devices, between at least two participants. The term has come to include not only communication through computers, as the name

suggests, (e.g. instant messaging, chat rooms, e-mail), but also communication enabled through cellphones or smartphones (text-messages) which has grown to become an exceptionally popular way of conveying messages in a quick and efficient manner. During 2011, 18.5 billion text messages were sent in Sweden (Statistiska Centralbyrån, 2013); in the UK, text messages peaked the same year with the impressive number of 39.7 billion sent SMS (Garratt & Poulter, 2014).

CMC has been described as a language completely different from Standard English: “a language all of its own” (Thurlow, 2006). However, non-standard versions of the English language produced online or through a cellphone are not much different from other language varieties, e.g. slang or dialects (Baron, 2000; Horobin, 2013). In the same way as new technologies simply do not replace older, communicative practices do not break completely from former, or more conventional, language use (Thurlow, 2003). Furthermore, CMC has been identified as something in between spoken and written language consisting of features ‘typical’ of both (Baron, 2000; Crystal, 2004; Plester, 2008; Thurlow & Poff, 2011). It is dialogic in its character in the same way spoken language is, but grammatical omission, which is also a feature of CMC, is rarely found in spoken language.

The language used in CMC is commonly referred to as *textisms*, *netspeak*, *text speak* and *textese* (e.g. Farina & Lyddy, 2011) and shortenings (*bro*, *sis*, *wed*), clippings (*goin*, *comin*), letter homophones (*gr8*) and plausible versions of either accented or standard pronunciation are examples of characteristic features of CMC (Plester et al, 2009; Powell & Dixon, 2011; Thurlow, 2003). Misspellings (were [for we’re], comming [for coming]) are features not exclusive for CMC but often found in text messages and online communication (Plester et al, 2009).

To further clarify why misspellings are relevant for this review we turn to a study conducted back in 1997 (Dixon & Kaminska). In this study it was revealed that adults who were exposed to misspellings tended to misspell themselves. Even though the participants in the study were divided into groups of ‘good spellers’ as well as ‘poor spellers’ (due to a pre-test), a connection between exposure to misspellings and worse spelling accuracy was evident in both groups. In other words, spelling results declined from pre-exposure test to post-exposure test. On the other hand, exposure to correctly spelled words had a positive effect on spelling accuracy (i.e. the participants improved their spelling results in the post-exposure test). As mentioned earlier, misspellings do not appear only in CMC, but are often found in this type of less revised written language. So, for the scope of this paper, misspellings are also referred to as features of CMC.

Considering technology's major impact on communicative language, it is no surprise that technology has been in the firing line of accusations, as well as been pointed out to be the source of the declining standards of 'proper' language use. Moreover, to be able to better understand how spelling came to be linked to technology and CMC, it is helpful to look into various learning theories presented in current studies on the topic. The theories provide, to some extent, support for the proclamation of textisms undesirable effects on literacy.

Firstly, *retroactive interference* and *decay theory* (as discussed in Drouin & Davis, 2009) are two memory theories that can provide two possible explanations for a decrease in spelling proficiency. Retroactive interference theory proposes that more recently learned information, in this case spelling, might intrude on previous knowledge. For example, a person who once learned to produce the standard spelling of a word might forget how to do so if a non-standard version of the word is learned and used repeatedly. In other words, new (recently learned) information may interfere with older (previously learned) information. Decay theory suggests that learned information (e.g. the standard spelling of a word) not seen or used may fade over time. For example, if textisms and non-standard spellings are visible on a daily basis, and the standard versions are not, it might be more difficult to remember the standard form.

Secondly, *Low-Road/High-Road Theory of Transfer of Learning* and *Situated Learning* (as discussed in Rosen et al, 2010) also provide explanations to negative effects on spelling due to CMC. Low-Road/High-Road Theory proposes that exposure to textisms might cause unconscious transfer of these features to similar writing, that is, informal contexts (low-road), but at the same time avoid transfer to formal writing (high-road). Situated Learning theory suggests, in this case, that once textisms are learned, they will unintentionally be transferred to general writing. This could possibly lead to the inappropriate transfer of non-standard spelling on to more formal writing as well.

Nevertheless, research needs to be consulted in the attempt to map out technology's actual impact on literacy and standard spelling, whether positive or negative. Therefore, this review aims at mapping out what current research tells us about the effects of CMC on literacy and standard spelling.

## **2 CMC and standard spelling**

Several studies have been conducted in the fields of CMC and literacy. Whereas the concept of literacy is referring to a group of complex skills, including both writing and reading, the

main focus of this review is to examine the connection between CMC and ability to produce standard spelling. Furthermore, the term literacy does not only entail someone's ability to merely read a text or write a word, but awareness of language appropriate to different situations is also an important part. It can also be seen as relevant to point out that being able to spell a word in two or three different ways does not necessarily mean that one could use the different variations correctly or appropriately (ACT Government, 2015). Different skills are often intertwined and it is therefore appropriate to present studies conducted on CMC in relation to literacy skills in general, and to spelling proficiency in particular.

Initially, current studies, carried out on CMC's effects in formal and informal contexts, will be examined. The section aims at providing a clearer picture of CMC's impact, in both formal and informal settings. Then, studies conducted on participants at different educational levels are being reviewed. This section seeks to evaluate the differences and similarities between students at different levels of proficiency and the impact of CMC on both. Studies on both positive and the negative aspects of CMC and literacy will be presented and problematized, and implications of CMC in education will be discussed.

## 2.1 Formal versus informal context

Drouin and Davis (2009) conducted a study with 80 college students, addressing the implications of text speak on literacy in both formal and informal contexts. The participants were divided into two groups, text speak users (34) and nontext speak users (46). The participants in both groups carried out six different tasks: construction of two e-mails (one in a more formal context and one informal context), translation of sentences from standard English to text speak, word ID, reading fluency, spelling, and a survey. These different standardized tests were used for assessment of the participants text speak vocabulary, their knowledge of the difference of text speak and Standard English registers, and, lastly, the connection between text speak use and literacy.

The results showed that a more frequent usage of text speak is not notably associated with lower literacy levels. Furthermore, results showed that high-frequency use of text speak is not related to a higher number of spelling errors either. Also, in the e-mail task, 75% of the students indicated that text speak (i.e. non-standard spelling) is appropriate for the context of written communication with friends (informal writing), but only 6% used it in the formal context (e-mail to instructor). Moreover, the results indicate that both texters and nontexters were able to differentiate between informal and formal registers, and avoided the use of non-standard spelling.



Expanding the knowledge of the field, Rosen et al (2010) provides insight into a notably negative relationship between CMC and formal writing among young adults', aged 18–25. The study set out to explore the connection between participants reported use of textisms, and the quality of their writing (the quality were measured in relation to the used scoring rubric where 6 is the highest and 1 the lowest). Educationally, the participants were sorted in groups of 'had not taken any college courses', 'had some college' and 'held a college degree'. Instead of having the participants tested through standardized tests (cf. Drouin & Davis, 2009), they were asked to perform a brief formal writing sample, as well as a brief informal writing sample. The study was carried out on two different occasions (study 1 and study 2) close in time, and are nearly identical. Hence, the report consists of, an analyses data collected from two different occasions.

The participants were asked about their daily communication through CMC; that is, how many minutes per month they used a cell phone and how many text messages they sent every month. Participants were also queried on how often they used textisms in e-mail, text messaging and Instant Messaging. The types of textisms the participants said they used were divided into four linguistic types of textisms; acronyms (*LOL* or *L8R*), the use of lowercase 'i', removed apostrophes from for example 'don't', and shortened words. Textisms were further divided into, what the authors call, contextual textisms. These included inserted smilies, the use of special characters to express emotional states, and the use of capital letters to express strong emotions. 495 participants completed the formal writing samples (238 from Study 1 and 257 from Study 2), and 254 participants completed informal writing samples, enabling a quite large body of data being analyzed.

All participants (study 1 and study 2) were asked to write a response to "*pretend that you want to complain to a company from which you bought a product. Write a letter to the company manager complaining about the quality of service that you received or the product itself and what you want them to do about it*" (formal writing sample). In study 2, the participants were also asked to provide a sample of informal writing responding to the task "*please describe in detail what it feels like to be unhappy. What should a person do to become happy again? What have you done in the past when you were unhappy?*"

Results show that among the participants without any college education and participants with some college, a high use of shortened words in electronic communication seemed to be connected to worse formal writing, which means that inappropriate spelling seemed to be carried over from contexts outside of school, into formal writing. Also, the overall quality of writing was seemingly lower for this group. However, in connection to the use

of shortened words in electronic communication, no significant effect was found among the participants with a college degree. Neither was the reported use of other textisms related to worse spelling, or over all writing, for those with a college degree. In other words, students at a lower educational level (no college education or some college) appear to be affected negatively by their use of shortenings and textisms when producing formal writing; that is, non-standard spelling seems to be transferred on to formal writing. Participants with a college degree, on the other hand, are not affected to the same extent. However, a positive connection between a regular use of text messages and informal writing was found across all participants, independently of educational degree. It is important to note that the positive connection between the use of textisms and informal writing relates to the over all quality of writing (and scored accordingly), but is not necessarily related to better standard spelling. In sum, the extensive study showed that among young adults there seems to be a positive connection between textisms and the over all quality of informal writing, but a negative connection between textisms and formal writing, although, the latter only among participants at a lower educational level (no college or some college).

In spite of the large sample of written texts analyzed in the reviewed paper by Rosen et al (2010), it should be noted that the writing samples were written in an artificial environment and real life writing in a classroom may give different results due to the teachers explicit instructions. In the study, participants were not told to use, or not use, shortened words or textisms, which may have signaled a more lenient attitude towards those linguistic features in formal writing. Additionally, an even larger amount of writing samples, as well as a more diverse population, could provide for a more nuanced and exhaustive analysis.

The year after, Drouin (2011) wanted to re-examine Drouin et al's (2009) findings on the relationship between texting, text speak and literacy. As mentioned previously, the results had shown that a more frequent usage of text speak was not connected to lower literacy levels, nor a higher number of spelling errors. The reason why a new study was conducted was the high number of participants claiming that the use of text speak did hurt their literacy, even though the experiments did not support this impression (see; 2.2). This time, two main research questions were focused on; "*Is there a negative relationship between text messaging frequency and literacy?*" And, "*Is there a negative relationship between textese use in different contexts (e.g. text messages, email and SNS) and literacy?*" (p. 70). The participants, 152 college students, carried out two standardized reading test, one letter-word identification test, and one reading fluency test (maximum score was 76 and 98), a standardized spelling test (maximum score = 76), and a survey. In the survey, the participants answered questions about

frequency of use of SNS (Social Networking Sites), text messaging, as well as questions concerning their use of textese (textisms) in four different contexts; emails to friends, emails to instructors, SNS, and in text messages. The answers from the survey were analyzed in relation to the participants spelling and reading scores.

Results showed that participants use textese more often in informal settings, such as emails to friends and in text messages, but rarely on SNS and in emails to professors. Whereas previous research by Drouin and Davis (2009) showed neither positive nor negative correlation between text messaging and literacy skills, this study shows that text messaging frequency is significantly and positively related to spelling scores and reading fluency. However, the use of textese in the specific cases of SNS and emails to professors, seems to be connected to worse reading accuracy, but no negative effects was found on spelling. What can be noted in this study is that participants were queried on their use of textese in formal contexts. Even though participants claimed they do not use textese when writing emails to professors, one cannot assume that this necessarily reflects real life practice.

In summary, empirical studies done on the effects of CMC in formal and informal contexts, shows different results. Whereas Drouin and Davis (2009) suggest that college students, both text speak users and nontext speak users, are able to differentiate between formal and informal registers, Rosen et al (2010) show a negative relationship between text speak use and standard spelling in formal writing. However, this negative connection was only evident with participants with no or little college education, and a positive correlation was found between CMC and informal writing among all educational levels. Results from Drouin's (2011) study indicate that the use of textisms in a formal setting (emails to professors) is negatively connected to reading accuracy, but not to standard spelling.

## **2.2 Differences and similarities between levels of education**

As touched upon in previous section (2.1), participants at different educational levels seem to be affected differently by the use of shortenings and textisms (Rosen et al, 2010). In a formal writing sample, participants with no college education, and participants with some college education, seemed to be affected negatively by their use of CMC. Notably, this correlation was not found among participants with a college degree. Instead, participants with a college degree seemed unaffected by their use of shortened words and textisms in emails, text messages and instant messages, and did not transfer these features into formal writing. The results from the study by Rosen et al suggests that educational level plays a part when

investigating CMC's impact on formal writing. However, the relation between CMC and informal writing showed to be positive throughout the participants, regardless of educational level.

A relatively recent study by Powell and Dixon's (2011) ties to the paradigm developed by Dixon and Kaminska (1997), who illustrated that in experiments where adults were exposed to misspellings they tend to misspell themselves. Powell and Dixon wanted to see if exposure to textisms had the same negative impact as exposure to misspellings had on adults' spelling accuracy. The participants, 94 undergraduate students, were tested on their spelling of 30 words, both before and after the exposure phase. Before the exposure phase, participants were divided into two groups – one group was exposed to 15 misspellings (out of the 30 words they had been tested on earlier), the other group to 15 textisms. Directly after the exposure to either misspellings or textisms, a post-exposure test was carried out consisting of the 30 words from the pre-exposure test. Interestingly, the group exposed to textisms improved their spelling scores, from pre-test to post-test, whereas the group exposed to misspellings showed, as expected, negative effects on their post exposure test. After exposure to correctly spelled words, participants improved their spelling from pre –to post-test. In sum, among undergraduate students, spelling performance decreased following exposure to misspellings, but increased following exposure to correct spellings and, notably, to textisms. The authors raise the question on the effects of exposure to textisms on children's spelling outcome and call for further research addressing this group of learners.

Results from the GCSE (General Certificate of Secondary Education) English test have been compiled and analyzed in an extensive report, published by the University of Cambridge (Massey, Elliott & Johnson, 2005). Test results from 1980 up until 2004 were collected and compared focusing on vocabulary, spelling, punctuation, sentence structure and non-standard English. In contrast to the claimed decrease in language standard (see, Thurlow, 2006), the results showed that the overall standard in English writing had increased since 1980. In the case of spelling, the results had neither improved nor declined. Massey et al point out that in the samples from 2004, only two spelling errors could be traced to text messaging; 'u' (for 'you) and 'thanx' (for thanks). This indicates that technology cannot be accused of affecting language proficiency in a negative manner, at least not between the years 1980's and 2004. However, in a more recent report, measurements concerning writing proficiency in England indicate that young people's writing results have recently plateaued (Clark & Dugdale, 2009).

Dixon and Kaminska (2007) studies the effects of children's (aged 10–11) exposure to orthography in forms of both correctly spelled words (i.e. standard English spelling) and misspelled words. To be able to support or oppose previous research carried out on adults showing that reading misspelled words had a negative impact on spelling outcome (Dixon & Kaminska, 1997), the 93 participants were divided into four different test groups: a spell group, a read group, a text group and lastly a control group. First, all participants carried out a pre-test. Second, the spell group read and then copied the spelling of the given words (40 items), the second group (read) were asked to read words aloud from a card, and the third group (text) were given a story to read where the target words appeared but where not pointed out. The control group had no exposure to the target words. Among the 40 words that the read –spell –and text group were exposed to, half the items were misspelled whereas the rest were correctly spelled. After the exposure phase, a post exposure-test was conducted. In relation to the effect of misspelled words, the results showed no significant difference between the group that had not been exposed to misspellings (control group), and the experimental groups. Evidently, these results do not support the results from the studies carried out on adults, where the exposure of misspelled words had a negative effect on spelling outcome. However, the results on the effects of exposure to correct spellings among children showed a positive outcome, which means that the participants spelling scores increased after exposure to correctly spelled words. In sum, results indicate positive spelling outcomes due to exposure to correct spelled words among children, but no significant effect due to presentations of misspelled words was found.

Even though no studies have been carried out on children, considering the effects of the direct exposure to textisms on childrens' spelling, Plester et al (2008) provide for insight into the relationship between texting habits, knowledge of abbreviations and school achievement in writing among 10-12-year olds. Within the same report, two different studies were carried out, but with conflicting results. While the studies were rather similar, the age of the participants differed as well as the focus. In the first study the aim was to explore whether academic outcome differed according to text message use. In the first study the students were between the ages of 11–12, and in the second between 10–11. The students were asked to translate sentences, one from standard English into a text message, and the other from an artificial text message into standard English. The results from this exercise were compared to the students' verbal reasoning scores (that had been measured beforehand), and a positive relation between a more dense use of abbreviations in the exercises, and verbal reasoning ability was found. However, the students who said they used their cellphones to send three or

more text messages a day, tended to have a lower score on the verbal reasoning test than those who said they sent none. These two results may seem to be contradicting each other. One can see that frequent use of text messaging and the use of ‘typical’ text message language may affect verbal reasoning scores differently. The authors explain these contradicting results by suggesting interfering variables; possibly cultural that might explain the correlation between a more frequent text messaging and lower verbal reasoning scores. Whether this is a valid explanation is not stated.

Further, since Study 1 gave mixed results, a second test was conducted with slightly younger participants (10–11 years old). An examination of the relationship between textism use and participants’ spelling and writing performance were addressed more specifically. A relationship between standard English (or ‘school language skills’) and phonologically based textisms was found. In addition, youth code language, also referred to as accent stylization (Thurlow, 2003), showed to be positively related to language proficiency. An explanation to this is that accent stylization represents regional dialects or accents (e.g. *ello*, *wiv*) that are also based on phonetic awareness as a transformational key factor. In other words, a strong relationship between textisms that are phonologically based, deriving from phonological awareness, and school language skills is found in Plester et al’s study on 10-11-year-olds.

The year after, another study by Plester et al (2009) was published, conducted on 88 children in the same age group as previous study (Plester et al, 2008). The study aimed at extending the understanding on the positive connection between standard literacy and knowledge of textisms. Further, the study suggested, as previous results (Plester et al, 2008) indicate, that at a lower stage of development (i.e. a lower proficiency level), there is no proof that children consuming and producing textisms would be negatively affected by this when writing standard English. Furthermore, the results indicate that children are able to produce standard spelling when called for.

Even though no substantial decline in standard English proficiency is found among text speak users; 49% of the college students in Drouin’s and Davis’s study (2009) thought that the use of text speak made it more difficult to remember standard (English) spelling. Furthermore, 55 % indicated that text speak usage could possibly bring negative effects on Standard usage. Conversely, a telephone survey carried out in 2007 by the Pew American & Internet Life Project showed different results. The participants in this study were slightly younger and only 11% of the participants said that the use of CMC harmed their writing, and 73% stated that it had no impact (Lenhart, Arafeh, Smith & Macgill, 2008). This comparison suggests that adults believe that CMC might harm their spelling, whereas a younger

population does not share this concern, and although only a small number of studies have been investigating people's own experiences of the effects of CMC, the existing research indicate that experienced negative effects of CMC may exist within a native speaker context. It is arguable that more research is needed. Larger studies would possibly provide for a clearer picture over CMC users perceived decline in spelling, both among college students as well as students on an elementary level. A larger sample could provide for a more coherent picture and also give a glance at what reasons exist behind the perceived decline in spelling.

In conclusion, level of education seems to play a part in how one is affected by the use of textisms. Participants with a college degree, that is, people at a higher educational level, are seemingly not affected by their textism use. However, adults at a lower educational level are (Rosen et al, 2010). Also, adults seem to spell worse due to exposure of misspelled words, but this correlation was not found among children. Neither are children negatively affected by textism use (Plester et al, 2008; Plester et al, 2009). Another relevant comparison to make is between the college students in Drouin's and Davis's study, and the 12-17-year olds in the study by Lenhart et al (2008). Remarkably, 55% of the college students thought that text speak could possibly affect their writing negatively, but only 11% of the teenagers said the same, and 73% said it had no impact at all.

### **3 Discussion**

This review set out to investigate CMC's impact on spelling. It began by high lightening the debate about standard spelling, as well as CMC's suggested impact on literacy. Furthermore, a presentation of the digital era was offered to contextualize the mentioned debates, as well as to frame possible implications for digitalization in language education.

Additionally, relevant features of CMC were defined, and four learning theories were addressed: Retroactive Interference Theory, Decay Theory, Low-Road/High-Road Theory of Transfer of Learning, and Situated Learning. The selected theories aimed at providing a framework for the reviewed field of research. Further were studies exploring CMC in formal and informal contexts presented, as well as studies on CMC's impact on both children and adults. Furthermore, in relation to methodological issues, the sometimes conflicting results will now be discussed. Some possible implications for language education will be examined, and suggestions for further research will be put forward.

In the reviewed studies, possible methodological issues are often connected to ethical considerations. One could argue that authentic, and genuine, data, for example real text messages, would provide for a more accurate picture of what language is being produced

through CMC. This would further provide for a more valid body of data and enable a better analysis. However, CMC is often used for private communication between for example friends or family members, and it can therefore be problematic to collect this kind of data. Researchers are instead required to ask participants about their CMC use (e.g., Drouin and Davis, 2009; Drouin, 2010; Plester et al, 2008; Rosen et al, 2010), construct translation tasks (Drouin and Davis, 2009; Plester et al, 2008) and/or provide for writing samples, similar to real life communication (Rosen et al, 2010). These artificial investigations could have an impact on the results. Even if tasks are set out to imitate authentic communication, participants are aware of the fact that they are being observed, and may consciously, or unconsciously, modify their responds.

Moreover, the mentioned methodological differences can provide for a possible explanation to the dubious results. If studies are carried out in one specific period in time, results may be different when conducted in another time, in another contexts, and with different participants. However, some results presented in this review seem to indicate agreement, for examples the studies showing that adults seem to be negatively affected by exposure to misspelled words (Dixon and Kaminska, 1997; Powel and Dixon, 2011), whereas children are not (Dixon and Kaminska, 2007). Also, the exposure to, and the use of, textisms may not be as harmful as media have suggested (Thurlow, 2006). Interestingly, studies even show that textisms might have a positive impact on spelling and literacy, at least in the case of informal writing (Rosen et al, 2010; Powell and Dixon, 2011; Plester et al, 2008). Nevertheless, a longitudinal study, examining participants' literacy proficiency over a long period of time, would expand the knowledge in the field of research on CMC's effects on standard spelling.

Considering the aim of this paper, it is relevant to discuss the implications technology and CMC bring into to the language classroom. It is evident that most students today are already surrounded by technology and are, most probably, communicating proficiently through CMC. So, what is the role of technology in language teaching, one might ask. Since CMC is a language variation (Baron, 2000; Horobin, 2013) it can function as a starting point for a discussion on registers and appropriateness. Rosen et al's (2010) study showed that text speak users at a lower educational level struggled with formal writing, and it can therefore be beneficial to focus on CMC in relation to this writing context. When, how, and to who are different language variations appropriate to use, and what are the effects of an inefficient language use? So, even though results did not show a negative impact on spelling per se, it is



valuable to cater for a raised awareness on when and where different language varieties are appropriate.

Furthermore, considering the implications of the constantly growing Internet (Goddard and Geesin, 2011), texts online are not always revised and misspellings may occur. Moreover, since studies show that exposure to misspellings can affect spelling outcome in a negative manner (Dixon and Kaminska, 1997; Powell and Dixon, 2011), it is important to pay attention to this in the language classroom, especially if online texts are used as learning material. Additionally, a critical eye is not only crucial when examining information found online; students must also learn to critically examine and assess doubtful spelling found on the Internet or received through a cell phone.

Lastly, while studies on the field of CMC and spelling showed noteworthy results, future research would benefit from looking into CMC's effects on standard spelling in a second language context. Are the results on first language learners applicable to second language learners, and will similar results be evident? Another interesting field of inquiry is that of adult learners' proclaimed experiences of CMC's negative effects on their ability to remember standard spelling. Is the feeling of CMC's harmful effects illegitimate, as the existing research suggest, or are there underlying factors not yet discovered?

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