Automated Text-checkers: A Chronology and a Bibliography of Commentary

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October 2005
Published in *Computers and Composition Online*, Fall 2005
<http://www.bgsu.edu/cconline/prodev>

Textcheckers—computerized spell-checkers, grammar-checkers, and style-checkers—have been around for three decades. The programs compare words in a textfile against a vocabulary of conventional spellings, generate the rate of passive constructions and raise a red flag if the rate is too high, question clichés or idiomatic expressions, capitalize the next word after a full stop, calculate "readability" formulas, and perform a host of other operations. Currently, integrated into all the popular word-processing and email packages, text-checkers are endemic to digital composing. Usually they function willy nilly, unless the writer has the initiative and know-how to turn them off.

What has been the composition community's reaction to this now pervasive—some would say invasive—machinery? Individually, the response varies. Bob Broad records one teacher apparently evaluating a student's spelling errors more harshly because the student's class met in a computer classroom: "Do they use spell check?" Yet another of his teachers excuses a student who had misspelled a proper name because "the spell-checker's not going to pick that up, so I gave him a little leeway there" (*What We Really Value: Beyond Rubrics in Teaching and Assessing Writing*, Utah State University Press, 2003, p. 115). Collectively, it is hard to say how the writing-teacher community has dealt with the encroachment of text-checkers over the years into their evaluation procedures and other teaching practices. There is no substantial review of the literature.

For some baseline information to help answer the question I have put together a chronology of the technology of text-checkers along with a bibliography of substantive commentary on them. I have sorted the history of the technology and the history of the commentary year by year, better to see patterns and interrelationships. My time-line bibliography is intended for the use especially of writing teachers and writing scholars—across the academic disciplines and in the workplace—and is offered with the hope that informed critique of this particular piece of auto-instructional technology will continue.

In gathering and organizing the material, however, I observed three curiosities that I can't resist passing on. The first has to do with the accuracy of the text-checking programs. Fairly early in their history the imperfect performance of text-checkers was noted (e.g., Frase, 1981; Sommers, 1982). Spell-checkers are more accurate than grammar-checkers, of course. But in either case, the rate of inaccuracy is not minimal. Using student writing, Collins (1989) and Brock (1993) compared non-spelling mistakes detected by the most popular programs (Sensible Grammar, RightWriter, Grammatik, etc.) with those detected by writing teachers, and found machines and teachers identifying the same mistakes less than 10% of the time. It can be argued that the detection of any amount of error in a student's writing is a bonus for the student, but that disregards the times the programs identify correct forms as incorrect. Typically false positives or "false flags" will make up 30% to 40% of the instances the software will identify as error. What I find remarkable is not the weak performance of the software but the fact that this inaccuracy has been reported for twenty-five years now and little seems to have come of it. Software designers don't improve their products, and teachers don't seem to mind students using them. Bruce Wampler, who spent seven years improving his grammar-checker program, Grammatik, before selling it to WordPerfect in 1992, remarked in 2002 that he believed WordPerfect had made no changes in the code since then (Kies 2005). Kathleen Kiefer, who helped develop Writer's Workbench in

the early 1980s, argues that it is still more accurate than the most recent versions of Microsoft Word (cited in Mike Palmquist, "Tracing the Development of Digital Tools for Writers and Writing Teachers," forthcoming in Ollie Olviedo, Joyce R. Walker, and Byron Hawk (Eds.), *Digital Tools in Composition Studies: Critical Dimensions and Implication*, Hampton Press, forthcoming.

The comments by Wampler and Kiefer connect with a second curiosity, which involves what might be called the commodification of the technology. Roughly the text-checking capability moved from a mainframe "general inquirer" method with an embedded vocabulary and text processed via punchcards (1950's-1960's); to line-editors still connected to mainframe computers processing fixed-line text connected to a typewriter, a TV screen, or CRT display (1970's); to stand-alone programs that could analyze text via external disks connected to a personal computer (1980's); to bonus features of word-processing software packages that could be installed and activated if one wished to vet a text (1990's); to default features of word-processing programs that run constantly ("auto-correct") unless the user chooses to de-activate them (mid-1990's). In short the commodity has moved from self-controlled to automatic, from manifest to hidden. The curiosity is that scholars researching text-checkers seem to have bought into this process of commodity naturalization. The bulk of their critique has focused on the earlier stand-alone programs with little of it investigating the later integrated word-processing packages. Wampler himself notes the decline in critique, and argues that the decision to use a plug-in product was an "active choice," and that "since grammar checking has become a standard feature of word-processing, this self-filtering is gone" (Wampler 1995). The opposite could be argued, however. Maybe users did not lose some control of text-checking but gained it. With the integrated word-processing software, writers could apply text-checking on the fly, whenever in the act of composing they wanted it. Early on the crucial shift was expressed in Bryan

Pfaffenberger's piece for *Research in Word Processing Newsletter*, "Integrated Word Processing: Has it Arrived?" (1987), in which he fantasized his "exemplary writing tool: the green box on your screen is not merely a space in which to write; it's also a gateway to a world of writing accessories, all of which are available at a keystroke," including "a context-sensitive style guide." Five years later, in 1992, he had his exemplary tool when Microsoft Word 5.0 included a grammar-checker. Many users quickly learned not to install it since occupied about half of the program's memory partition, but industry soon solved that problem with improved memory chips. More and more the capability was built into the users' own machines. Critique of the programs may have faded the more they were "owned" by their purchasers.

Whatever the causes, they are related to the third curiosity, which is the overall decline of scholarship on text-checkers in the last ten years. I don't pretend that the following bibliography is complete, but I searched rather evenly over the years. Beginning with 1980 (the year after the release of WordStar as the first word-processing software including a spell-checker) and proceeding by two-year increments, here are the number of items.

1980-1981	17
1982-1983	33
1984-1985	59
1986-1987	42
1988-1989	37
1990-1991	32
1992-1993	36
1994-1995	13
1996-1997	15
1998-1999	5
2000-2001	7
2002-2003	7
2004-2005	6

The same phenomenon has been documented in studies of word-processing in general, by Bernard Susser (*Computers and Composition* 15.3, 1998, pp. 347-372). Perhaps we are looking at a particular combustion when technology and writing research meet that might be called the "novelty effect." The plug-in text-checker programs that dominated the market in the 1980's were more of a breakthrough technology than were the later integrated programs, most of which were just the old stand-alone programs with minor code changes (e.g., Grammatik built into WordPerfect, Correct Grammar into WordStar).

Or maybe we are looking at a commodification of scholarship that parallels the commodification of technology. A new technology often peaks early with number of launched products and then gradually decreases in volume as the few successful products take over the market; so in scholarship an early flurry of pieces is followed by a decline in production as scholars can find less new to say and only a few old pieces are perpetuated through reprints and citations. Let's hope not. Maybe all we are seeing is teachers losing interest in an aspect of teaching composition, attention to surface features, that more and more they have come to feel is secondary and that they are happy to turn over to mechanical household aids. Then the question is whether teachers are aware of how poorly the machines are doing the chores or how the students are getting along with the hired help.

In terms of scholarly understanding the bottom line is that there is much still to uncover, as a few recent analyses have brilliantly shown (e.g., McGee & Ericsson 2002, Haist 2004, Kies 2005). May the following bibliography do its small part in encouraging more of the same.

As for the parameters of the bibliography, I have focused rather tightly on hardware and software that supports spell-, grammar-, and style-checking. I do not include computerization of readability formulas, which forms part of many text-checking packages but which technologically and instructionally follows a somewhat different history. Nor do I include much commentary that deals with the development of editing and formatting software for publishing, which often contained grammar and spell-checking components; or with programmed autotutorial instruction ("teaching machines"), which typically dwelt heavily on grammar; or with the CAI interactive tutorial composing programs (TICCIT, WANDAH, HOMER, WORDSWORTH, SEEN, and a host of others), most of which included text-checking capability or links to it. Finally I have, reluctantly, omitted the scholarship on text-checking with special populations, for instance the fascinating work done on hardware and software for the visually handicapped, or for students learning English as a second language (e.g., Cornelia Tschichold, "Grammar checking for CALL: Strategies for Improving Foreign Language Grammar Checkers," in Cameron, Ed., *CALL: Media, Design and Applications*, 1999, Swets & Zeitlinger, pp. 203-222). Nor have I included the excellent work on accuracy of text-checkers in languages other than English (e.g., Jack Burston, "A Comparative Evaluation of French Grammar Checkers," *Calico Journal* 13.2/3 (1995), 104-111). Largely I have also excluded the growing literature—because it is a growing technology—on automated grading or scoring of student writing. That material will be found in a bibliography of its own, appearing in *Machine Scoring of Student Essays: Truth and Consequences*, edited by Patricia Ericsson and myself, in press at Utah State University Press. Finally, I should note that I have mostly omitted mere notices or descriptions of new technology.

There are 336 items. The first, up to about 1970, are here just to indicate a few precursors to the composing and instructional text-checking technology that came later. I have appended a few search terms to each entry, but please do not trust them too much. Here are some non-intuitive search terms.

accuracy: testing of the degree to which text-checking programs succeed in detecting solecisms and ignoring non-solecisms

basic: study involving remedial writing courses

computer-analysis: computerized analysis of text for diagnostic purposes, including checking of spelling, grammar, or style (terms which overlap, of course)

data: study extracting factual information that would allow for replication of the study

instruction: scholarship addressing the teaching of writing anywhere

machine-scoring: computerized analysis of text to give it an evaluative score or grade

record-keeping: computer software that assists information recording, such as grades, attendance, or summed points.

school: study involving grade-school, middle-school, or high-school instruction (the default is post-secondary instruction)

Year	Hardware support	Software application	Journals	Literature
1960-1965	The standard technique is running punch cards in batch mode through a mainframe machine. Text analysis relies mainly on word and phrase matching and frequency counts. In 1960 Digital Equipment develops the PDP-1, the first minicomputer with	Application of computers to the humanities (especially anthropology, linguistics, literature, and history) has been under way for several decades. For composition instruction, lock-step grammar and spelling programs are being developed to be used in "teaching machines" such as the Dukane Redi-Tutor, which was a frame-controlled film projector. Early		• Reitman, Walter R. (1962). Computer models of psychological processes and some implication for the theory and practice of writing. In Steinberg, Erwin Ray (Ed.), Needed research in the teaching of English: Proceedings of a Project English research conference, May 5-7, 1962; Washington, D. C.: U. S. Department of Health, Education, and Welfare, Office of Education. Pp. 98-106. *machine-scoring, CAI, computer-analysis* • Rothwell, Kenneth S. (1962). Programmed learning: A back door to empiricism in English studies. College English 23.4, pp. 245-250. *programmed, teaching machine* • Engelstrom, John; James Whittaker. (1963. Improving students' spelling through automated teaching. Psychological Reports 2, pp. 125-126. *programmed, teaching machine* • Rowland, Devra. (1964). Decade in the life of a programmer. College Comosition and Communication 15.2, pp. 90-96. *porogrammed, basic, teaching machine, computer-analysis*

	keyboard and monitor. IBM's magnetic tape Selectric typewriter was marketed in 1964, allowing users to edit recorded text or erase it and start over. The first local area network (LAN) established, at Rank Xerox Palo Alto Research Center	programs were IBM's Teaching Machine Project (eventually installed at Stanford University and 29 other sistes), and the University of Illinois's PLATO (Programmed Logic for Automatic Teaching Operations)		• Holsti, Ole R. (1964). An adaptation of the "General Inquirer" for the systematic analysis of political documents. Behavioral Science 9.4, pp. 382-388. *computer-analysis, general inquirer, political-science text, semantic*
1966-1967	Hewlett-Packard introduces a general purpose computer that supports BASIC, FORTRAN, and other computer languages. Standard text manipulation is still fixed 64-character line editing (no wrap-around)		*Computing and the Humanities Newsletter* launched in 1966, to become *Computers and the Humanities* the next year.	• Daigon, Arthur. (1966). Computer grading of English composition. English Journal 55.1, pp. 46-52. *machine-scoring, computer-analysis, CEEB, spell-checker, usage, style* • Page, Ellis B. (1966). Grading essays by computer: Progress report. Educational Testing Service (Ed.), Proceedings of the Invitational Conference on Testing Problems, October 29, 1966, New York City: Princeton, NJ: Educational Testing Service. Pp. 87-100. *machine-scoring* • Stone, Philip J.; John Kirsch; et al. (1966). The General Inquirer: A computer approach to content analysis. Cambridge, MA: M.I.T Press. *computer-analysis, content-analysis, General Inquirer, essay*
1968	Douglas Engelbart shows full-screen word processing			• Bhushan, V.; J. R. Ginther. (1968). Discriminating between a good and a poor essay. Behavioral Science 13.5, pp. 417-420. *computer-analysis, general inquirer, sentence length,*

	and the mouse at the Fall Joint Computer Conference in San Francisco—for word processing the first step away from the line editors		*vocabulary, semantic*
1969	Data General markets Nova, the first 16-bit mini-computer. IBM produces MagCards for their typewriters, holding about a page of text, a precursor to the floppy disk. First ARPANET network established between UCLA, Stanford, UC Santa Barbara, and the University of Utah		• Hiller, Jack H.; D. R. Marcotte; T. Martin. (1969). Opinionation, vagueness and specificity-distinctiveness: Essay traits measured by computer. American Educational Research Journal 06.2, pp. 271-286. *computer-analysis, vagueness, opinionation, specificity, data*
1970-1971	Intel introduces the RAM chip, computer storage that can be randomly accessed	Wang is one of the first to buy the Intel chip, and introduces their 1200 Word Processing System the next year.	• Woods, Elinor M. (1970). Recent applications of computer technology to school testing programs. Review of Educational Research, pp. 525-539. *review of research, machine-scoring, computer-analysis, school*

	and written to as well as read from	Autotutorial programs in spelling, grammar, and puncteuation, TICCIT (Time-shared, Interactive, Computer-Controlled Information Television_developed at Brigham Young University (1970-1975)	
1972	"Fourth generation" computers with circuits of 500 or more transistors in a chip—the hardware essential for the microcomputer. Wang, VYDEC, and Lexitron produce floppy diskettes, holding more than 200 pages of text.	Bell Laboratories (A&T) is developing their UNIX operating system to support word processing *t*	• Slotnick, Henry B. (1972). Toward a theory of computer essay grading. Journal of Educational Measurement 09.4. 253-263. *machine-scoring, computer-analysis, theory, measurement, evaluation, content, spelling, diction, syntax, punctuation, paragraph*
1973	Don Lancaster devises the TV Typewriter, which uses memory boards to store 512 characters; a cassette tape provides storage of		• Bishop, Robert; Nadean Bishop; Darien Gardner. (1973). Adapting computer-assisted-instruction to the non-programmer. ERIC Document Reproduction Service, ED 081 231. *CAI, computer-analysis, mainframe, programming, Journalism Computer Assisted Instruction, style-checker, vocabulary* • Koether, Mary, and Esther Coke. (1973). A scheme for text analysis using FORTRAN. ERIC Document Reproduction

	around 90 pages. The Alto workstation, with a bit-mapped video screen, is created at Xerox Palo Alto Research Center			Service, ED 074 152. *computer-analysis, FORTRAN*
1974-1975	The first two personal computers marketed: Micro Computer Machines's MCM/70 and MITS's Altair 8080 (with LED panel and extension cards for keyboard and screen)	Hewlett-Packard designs the Instructional Dialogue Facility for their 2000/F Computer System, with revising and contextual word-search capabilities	First issue of *Creative Computing*	• Bishop, Robert L. (1974). Computing in the teaching of journalistic skills. On-line 03.3, pp. 5-12. *computer-analysis, mainframe, journalism course, grammar-checker, passive, spell-checker, JOURNALISM* • Slotnick, Henry B. (1974). Computer scoring of formal letters. Journal of Business Communication 11.2, pp. 11-19. *letter-writing, experiment, data, machine-scoring, correlation, holistic, vocabulary-variety, word-length, spelling, computer-analysis*
1976	Apple Computer markets Apple I. Zilog releases the Z80 chip, an 8-bit microprocessor that was the underpinning of the personal and desktop computing for the next decade	Michael Shrayer writes Electric Pencil, considered by some to be the first personal-computer word processing program		• Riddle, Elizabeth A. (1976). Comparative study of various text editors and formatting systems. Springfield, VA: National Technical Information Service. *text-editor, line-editor, computer-analysis, survey* • Salton, Gerald and Anita Wong. (1976). On the role of words and phrases in automatic text analysis. Computers and the Humanities 10, pp. 69-87. *computer-analysis, lexicon, phrase*
1977	Three more personal computers			• Finn, Patrick J. (1977). Computer-aided description of mature word choices in writing. In Cooper, Charles R.; Lee Odell

Year			
	marked: Commodore's PET; Tandy's TRS-80; and Apple II with a floppy disk drive and color graphics		(Eds.), Evaluating Writing: Describing, Measuring, Judging; Urbana, IL: National Council of Teachers of English, pp. 69-90. *diction, vocabulary, machine-scoring, computer-analysis*
1978	Tandy improves the TRS-80 with Microsoft operating system to 32 KB of RAM, with floppy disk and printer. IBM advertises its Personal Computer. BITNET protocol set for email by Yale and City University of New York		• Brown, Francis J. (1978). A computer-calculated index. ERIC Document Reproduction Service, ED 154 337. *computer-analysis, readability, Gunning Fog index* • Gould, John D. (1978). Composing letters with computer-based text editors (Research Center 8446, No. 36750). Yorktown Height, NY: IBM Research Center. *computer-analysis, text-editor, style-checker, letter writing, business workplace* • Hartnett, Carolyn G. (1978). Measuring writing skills. ERIC Document Reproduction Service, ED 170 014. *evaluation, measurement, holistic, primary-trait, peer-evaluation, t-unit, sentence-combining, computer-analysis, cohesion, direct-indirect, data, basic, placement* • Card, Stuart K. (1978). Studies in the psychology of computer text editing systems. Palo Alto, CA: Xerox Palo Alto Research Center. *computer-analysis, editing, text-editor, error, spell-checker*
1979	IBM begins work on their own personal computer, to compete with Apple, Tandy, and Commodore—work that would lead to the IBM PC	Micropro International releases WordStar, commercially the most successful word-processing software for several years. It offers an add-on spell-checking program called	• Anandam, Kamala; Lorne Kotler; Ed Eisel; Rose Ann Roche. (1979). RSVP: Feedback program for individualized analysis of writing. ERIC Document Reproduction Service, ED 191 511. *computer-analysis, RSVP, Response System for Variable Prescriptions, error, record-keeping* • Hammer, J. M.; W. B. Rouse. (1979). Analysis and modelling of freeform text editing behavior. In Proceedings of the International Conference on Cybernetics and Society, Denver,

first shipped in 1981	SpellStar. Lorinda Cherry and Doug McIlroy at Bell Laboratories, consulting with style-analyst William Versterman of Rutgers University, continue to work with the UNIX operating system, developing "style" and "diction" functions. At IBM, George Heidorn and others begin work on EPISTLE, an on-line text-editing program later expanded with a style- and grammar-checker by Karen Jensen and Yael Ravin and marketed as Critique	8-10 October, 1979. New York: Institute of Electrical and Electronic Engineers. *experiment, ETUDE, composing, data* • Horodowich, Peggy Maki. (1979). Developing stylistic awareness on the computer: A tagmemic approach. ERIC Document Reproduction Service, ED 198 530. *computer-analysis, clause, feedback, Hewlett-Packard, Instructional Dialogue Author Facility* • Miller, George A. (1979). Automated dictionaries, reading and writing: Chairman's report of a conference on educational uses of word processors with dictionaries, June 14-15, 1979; Washington, D. C.: National Institute of Education. *computer-analysis, text-editor, word-processor, spell-checker*
1980	Commodore's VIC-20 released, with cassette storage and a TV screen for a monitor. IBM hires Microsoft to write the operating system for their PC. Usenet in operation at the University of	WordPerfrect is shipped for Data General minicomputers ($5,500 per copy), and WordPro for Commodores. Bell Labs releases UNIX 4.1BSD with "style" and "diction" functions. At MIT, Richard Ilson and Michael Good are designing ETUDE, an interactive editing and	• Anandam, Kamala; Ed Eisel; Lorne Kotler. (1980). Effectiveness of a computer-based feedback system for writing. Journal of Computer-Based Instruction 06.4, pp. 125-133. *computer-analysis, RSVP, Response System for Variable Prescriptions, error, record-keeping* • Card, Stuart K.; T. P. Moran; A. Newel. (1980). Computer text-editing: An information-processing analysis of a routine cognitive skill. Cognitive Psychology 12.1, pp. 32-74. *computer-analysis, line-editor, information-processing, cognitive* • Kanervo, Ellen. (1980). Teaching tips. Journalism Educator 35.3, pp. 18-27. *computer-analysis, style-checker, grammar-*

	North Carolina at Chapel Hill and Duke University	formatting program	*checker, grading, journalism course* • Moe, A. J. (1980). Analyzing text with computers. Educational Technology 30.7, pp. 29-31. *computer-analysis, text-editor, editing, readability, grammar-checker, spell-checker* • Peterson, James Lyle. (1980). Computer programs for detecting and correctly spelling errors. Communications of the Association for Computing Machinery 23 (December), pp. 676-687. *computer-analysis, spell-checker* • Peterson, James Lyle. (1980). Computer programs for spelling correction: An experiment in program design. Berlin; New York: Springer-Verlag. *computer-analysis, programmed, spell-checker*
1981	Sinclair's ZX81 released, a home computer with a cheap membrane keyboard, output to the TV set, and storage on an ordinary audio tape recorder. First portable computer released, the Osborne 1, weighing almost 24 pounds. Xerox introduces its Star Workstation, with a bit-mapped display on a monitor, icons, mouse, and ethernet.	IBM markets their PC with Microsoft-DOS operating system; with it was available a spell-checker, a plug-in package. LifeTree Software is founded and begins work on Correct Grammar, a stand-alone which will earn $4,000,000 in 1990. In collaboration with Kate Kiefer and Charles Smith at Colorado State University, Nina Macdonald, Lorinda Cherry, and other UNIX people at Bell Laboratories continue work that will eventuate with Writer's	• Cherry, Lorinda L. (1981). Computer aids for writers. Proceedings of the ACM SIGPLAN 16.6, pp. 61-71. *computer-analysis* • Cherry, Lorinda L.; William Vesterman. (1981). Writing tools: The "Style" and "Diction" programs (Computing science technical report, No. 91). Murray Hill, NJ: Bell Labs. *computer-analysis, style-checker, diction* • Cronnell, Bruce; Ann Humes. (1981). Using microcomputers for composition instruction. ERIC Document Reproduction Service, ED 203 872. *word-processing, computer-analysis, grammar-checker, revising, instruction* • Frase, Lawrence T.; Nina H. MacDonald; Patricia S. Gingrich; Stacey A. Keenan; J. L. Collymore. (1981). Computer aids for text assessment and writing instruction. NSPI Journal 20.9, pp. 21-24. *Writer's Workbench, computer-analysis, grammar-checker* • Frase, Lawrence T. (1981). Ethics of imperfect measures. IEEE Transactions on Professional Communications 24.1, pp. 49-50. *computer-analysis, readability-formula, measurement, accuracy* • Good, Michael. (1981). ETUDE and the folklore of user

| | | Workbench | interface design. SIGPLAN Notices 16.6, pp. 34-43. *computer-analysis, software, ETUDE, text-editor* |

- Miller, Lance A.; George E. Heidorn; Karen Jensen. (1981). Text-critiquing with the EPISTLE system: An author's aid to better syntax. In Orden, Alex (Ed.), 1981 National Computer Conference: May 4-7, 1981, Chicago, Illinois; Arlington, VA: American Federation of Information Processing Societies Press, pp. 649-655. *style-checker, EPISTLE, syntax, practice, computer-analysis, software, phrase matching*
- Oates, William. (1981). An evaluation of computer-assisted instruction for English grammar review. Studies in Language and Literature 03, pp. 193-200. *pre-post, experiment, CAI, journalism course, PLATO, gain, data, grammar-checker, computer-analysis*
- Schwartz, Helen J. (1981). Teaching stylistic simplicity with a computerized readability formula. Paper presented and the International Conference of the American Business Communication Association. ERIC Document Reproduction Service, ED 196 014. *computer-analysis, readability, instruction, style, STAR*
- Smith, Raoul N. (1981). Computerized aids to writing. In Frawley, William (Ed.), Linguistics and literacy: New York: Plenum Press, pp. 189-208. *style-checker, computer-analysis, Writer's Workbench, Epistle, revising, feedback, database, format, logical transition*
- Turba, T. N. (1981). Checking for spelling and typographical errors in computer-based text. SIGPLAN Notices 16.6, pp. 51-60. *computer-analysis, spell-checker, text-editor*

| 1982 | Compaq offers their Compaq Portable. Sinclair ZX Spectrum, and Commodore 64 is | WordPerfect—originally written by Satellite Software for minicomputers—is released in DOS format | |

- Cherry, Lorinda L. (1982). Writing tools. IEEE Transactions on Communications 30.1, pp. 100-105. *computer-analysis, Bell Laboratory*
- Collier, Richard M. (1982). The effect of computer-based text editors on the revision strategies of inexperienced writers.

released at much cheaper prices. First true laptop is marketed, the GRiD Compass 1101, with clamshell design (it sold for $10,000 and was used mainly by the military)

for the IBM PC

ERIC Document Reproduction Service, ED 211 998. *computer-analysis, text-editor, revising, two-year college, case-study, think-aloud protocol, instruction, data*

• Cottey, Patricia. (1982). An overview of the computer as teacher: A progress report of a research project to introduce diagnostic testing and computerized instruction into the composition program at Northeast Missouri State University. ERIC Document Reproduction Service, ED 217 490. *computer-analysis, grammar-checker, instruction, basic, programmed, diagnostic, PLATO*

• Cronnell, Bruce. (1982). Computer instruction for generating and revising/editing narrative text. Los Alamitos, CA: Southwest Regional Laboratory for Educational Research and Development [ERIC Document Reproduction Service, ED 223 244]. *CAI, interactive, practice, word-processor, revising, editing, style-checker, computer-analysis*

• Cronnell, Bruce. (1982). Computer-based practice in editing. ERIC Document Reproduction Service, ED 220 869. *CAI, instruction, editing, computer-analysis, mainframe, text-editor*

• Heidom, George E.; Karen Jensen; Lance A. Miller; Martin S. Chodorow. (1982). The EPISTLE text-critiquing system. IBM Systems Journal 21, pp. 305-326. *style-checker, computer-analysis, EPISTLE*

• Joyce, James. (1982). UNIX aids for English composition courses. Computers and the Humanities 15, pp. 271-276. *grammar-checker, Spell, Diction, Style, Bell Laboratories, computer-analysis, feedback.*

• Joyce, James. (1982). UNIX aids for English composition courses. In Bailey, Richard W. (Ed.), Computing in the humanities, pp. 33-38; Amsterdam: North-Holland. *computer-analysis, spell-checker, vocabulary, readability.*

• Lawlor, Joseph. (1982). Evaluating textual responses. In Lawlor, Joseph (Ed.), Computers in composition instruction (proceedings of a research/practice conference held at SWRL

Educational Research and Development, Los Alamitos, California, April 22-23, 1982); Los Alamitos, CA: SWRL Educational Research and Development, pp. 75-81. *CAI, microcomputer, student opinion, error, style-checker, spelling, sentence-combining, computer-analysis*

- Macdonald, Nina H.; Lawrence Frase; Patricia Gingrich; Stacey A. Keenan. (1982). The Writer's Workbench: Computer aids for text analysis. IEEE Transactions on Communication 30.1, pp. 105-110. *computer-analysis, style-checker, Writer's Workbench, software*
- MacDonald, Nina H.; Lawrence T. Frase; Patricia S. Gingrich; Stacey A. Keenan. (1982). The Writer's Workbench: Computer aids for text analysis. Educational Psychologist 17.3, pp. 172-179. *Writer's Workbench, computer-analysis, grammar-checker*
- Sommers, Nancy. (1982). Responding to student writing. College Composition and Communication 33.2, pp. 148-156. *commenting, revising, computer-analysis, spell-checker, grammar-checker, style-checker, Kincaid readability, data, accuracy*
- Wresch, William. (1982). Prewriting, writing, and editing by computer. ERIC Document Reproduction Service, ED 213 045. *CAI, computer-analysis, interactive, pre-writing, journalism course, editing, style-checker, text-editor data*

1983	Apple, IBM, and Xerox introduce personal computers with graphical user interface (icons and pop-up menus), disk drive, and printer. Apple's Lisa has a	Volkswriter and WordPlus-PC, both word-processing software, are available for the IBM PC. Weber State College collaborates with Automated Language Processing Systems to	The first professional journals for writing teachers dealing with computers are launched: *Research in Word Processing*	• Arms, Valerie M. (1983). Computers, creativity, and composition. In Burton, Sarah K; Douglas D. Short (Eds.), Sixth international conference on computers and the humanities; Rockville, MD: Computer Science Press, pp. 4-7. *computer-analysis, revising, CAI, software, Create, Format, grammar-checker, AFCAD editor.* • Bean, John C. (1983). Computerized word-processing as an aid to revision. College Composition and Communication 34.2, pp. 146-148. *revising, computer, word-processing,*

detached keyboard and mouse. Various laptops introduced: The Gavilan, the Kyotronic 85, and Sharp's PC-5000

develop a text-analysis program, ALPS, for their writing program; it includes a readability analysis and style chart.

Newsletter (edited by Bradford A. Morgan) and *Computers and Composition* (edited by Cynthia L. Selfe and Kathleen E. Kiefer)—along with *PC World* and *PC Week*

student-opinion, computer-analysis, data

- Bogert, Judith. (1983). Improving the quality of writing in the workplace. Management Communication Quarterly 02, pp. 328-356. *workplace, technical communication, computer-analysis, style-checker, grammar-checker*
- Gillis, Philip Daryl. (1983). The utilization of computer technology as a means of teaching and evaluating prewriting processes [dissertation]. Atlanta, GA: Georgia State University-College of Education. *pre-writing, process, evaluation, computer-analysis, instruction*
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<div style="color:red">
Hewlett-Packard releases their LaserJet printer. First internet TCP/IP system functioning as a university network built by the National Science Foundation. Apple Macintosh marketed at $2,500, with monitor and mouse and full graphical user interface—first a 128 KB version and then, 8 months later, a 512 KB one
</div>

<div style="color:blue">
MacWrite comes with the new Apple Macintoshes. Microsoft Word 1.0 issued, with no spell-checker or grammar-checker
</div>

style-checker, peer commenting, instruction
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- Kiefer, Kathleen. (1984). Writing: Using the computer as tool. In Olsen, Solveig (Ed.), Computer-aided instruction in the humanities; New York: Modern Language Association of America, pp. 90-102. *computer-analysis, style-checker, instruction, applicability, basic*
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| 1985 | CD-ROM technology by Philips and Sony. Commodore's Amiga home computer arrives with a multitasking operating system. Introduction of Adobe's PostScript, a page description language for printers. | Microsoft Windows OS issued, with user interface similar to Macintoshes. WordStar and WordPerfect are available now with spell-checkers. Some stand-alone spell-checking programs available this year (or within one or two years) are Spellex, Spellbinder, Spelling Sentry, AutoSpell, WordSpring, SpellMagic, QuickSpell, and Spell Catcher (originally named | First issues of *MacWorld: The Macintosh Magazine*, as well as the *Journal of Educational Computing Ressearch* and *Computers in Human Behavior* | • Dobrin, David N. (1985). Limitations on the use of computers in composition. ERIC Document Reproduction Service, ED 261 395. *computer-analysis, CAI, composition teaching, spell-checker, data, accuracy, EPISTLE, DICTION, STYLE, Bell Laboratory, word-processing*
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• Gallagher, Brian. (1985). Microcomputers and word processing programs: An evaluation and critique (CUNY Research Monograph Series Report No. 9). New York: New York: The City University of New York Instructional Center. *computer-analysis, word-processing*
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Thunder!). Bruce Wampler co-founds Reference Software International and begins work on Grammatik, grammar-checking software. ALPS released for the Macintosh as MacProof, a plug-in without the readability diagnosis but with Usage, Grammar, Structure, and Spelling functions.

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• Oliver, Lawrence J. (1985). The case against computerized analysis of student writing. Journal of Technical Writing and Communication 15.4, pp. 309-322. *computer-analysis, surface features, instruction, correctness*

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• Stibravy, John A.; Chuck Beck. (1985). Errors caused by the use of word processing in reports by beginning technical writing students. Research in Word Processing Newsletter 03.4, pp. 9-11. *computer-analysis, error count, data frequency, word-processing, technical writing, accuracy*

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Conference, May 19-22, 1985, Houston, Texas; Washington, D. C.: Society for Technical Communication, pp. ATA3-6. *technical communication, computer-analysis, style-checker, grammar-checker*
- Swain, Deborah E. (1985). Editing and usability tolls workshop. In Society for Technical Communication (Ed.), A mission to communicate: Proceedings, 32nd International Technical Communication Conference, May 19-22, 1985, Houston, Texas; Washington, D. C.: Society for Technical Communication, pp. ATA-23. *technical communication, computer-analysis, editing, grammar-checker, style-checker, usability*
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| 1986 | Apple releases the Macintosh Plus, with 4 MB of RAM. In England the Amstrad PC 1512 proved an affordable and user-friendly home computer | Microsoft Word 3.0 marketed, with a spell-checker and a thesaurus. Batteries Included releases PaperClip II, a low-cost word-processing package for Commodore 64, with spell-checker. There are now on the market many word-processing packages: WordPerfect, WordStar, Officewriter, | First issue of *The Computer-Assisted Composition Journal* (edited by Lynn Veach Sadler). IBM launches *PC Magazine* | • Craven, Jerry. (1987). A ready and easy way to establish an (almost) free computer-assisted composition course. Computer-Assisted Composition Journal 2.1, pp. 1-3. *computer-analysis, instruction, style-checker, RightWriter*
• Dobrin, David N. (1986). Style analyzers once more. Computers and Composition 3.3, pp. 22-32. *computer-analysis, accuracy, Writer's Workbench, accuracy, false flag*
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Microsoft Word,
MacWrite, Multimate
Advantage,
Displaywrite, Samra
Word, Professional
Write, Webster's New
World Writer, PC-Write

Technological Horizons in Education 14.3, pp. 74-78. *computer-analysis, software, Writer's Workbench, instruction, technical writing*

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• Hult, Christine A. (1986). The computer and the inexperienced writer. ERIC Document Reproduction Service, ED 271 772. *word-processing, computer-analysis, style-checker, revising, novice-expert, instruction*

• Kinkead, Joyce. (1986). Matching software and curriculum: A description of four text-analysis programs. Computers and Composition 3.3, pp. 33-55. *computer-analysis, style-checker, Grammatik, WANDAH, ALPS, Writer's Workbench, instruction*

• Larsen, Richard B. (1986). The one-computer classroom. Computers and Composition 04.1, pp. 46-60. *instruction, computer-analysis, Writer's Workbench, grammar-checker*

• Morgan, Bradford. (1986). Word processing, electronic research, and desktop publishing: Annual cumulative bibliography. Research in Word Processing Newsletter 04.5, p. 22-. *bibliography, word-processing, computer-analysis, desktop publishing*

• Mullins, Carolyn J. (1987). On teaching writing with PC's. Computer-Assisted Composition Journal 1.3, pp. 172-184. *computer-analysis, style-checker, RightWriter, Volkswriter, experiment, instruction, gain, data*

• Noble, David F. (1986). Word processing as a tool for revision. Research in Word Processing Newsletter 04.7, pp. 6-

16. *word-processing, computer-analysis, macro, revising*
- Ober, Scot; Marcella J. Kocar. (1986). The effect of student use of a computerized writing-analysis program on writing achievement. Delta Pi Epsilon Journal 28.2, pp. 99-106. *word-processing, computer-analysis, experiment, letter writing, editing, instruction, data*
- Pomper, Marlene M. (1986). Trial and error: The use of computer-aided instruction for basic readers and writers. ERIC Document Reproduction Service, ED 324 667. *basic, word-processing, computer-analysis, CAI, spell-checker, grammar-checker, record-keeping*
- Reid, Joy. (1986). Using the Writer's Workbench in composition and teaching. In Stansfield, Charles W. (Ed.), Technology and language teaching; Washington, D. C.: Teachers of English to Speakers of Other Languages, pp. 167-186. *computer-analysis, Writer's Workbench, style-checker, grammar-checker, instruction, testing, data, ESL*
- Reid, Stephen; Gilbert Findlay. (1986). Writer's Workbench analysis of holistically scored essays. Computers and Composition 03.2. 6-32. *computer-analysis, machine-scoring, style-checker, WRITER'S WORKBENCH, holistic, data, evaluation, correlation, essay-length, spelling, readability*
- Simon, Kathleen. (1986). Using computers to teach English composition classes. ERIC Document Reproduction Service, ED 276 056. *computer, programmed, interactive, CAI, drill, word-processing, apprehension, computer-analysis, spell-checker, bibliography*
- Sterkel, Karen S.; Mildred I. Johnson; Douglas D. Sjogren. (1986). Textual analysis with computers to improve the writing skills of business communication students. Journal of Business Communication 23.1, pp. 43-61. *computer-analysis, instruction, editing, business-communication, Writer's Workbench, student-opinion, grades, correlation, gain, data*
- Wessell, D. (1986). Computer software for writers: Helping

the bad, hurting the good. *The Wall Street Journal* (July 7): Section 15, p. 4. *style-checker, grammar-checker, efficiency, accuracy*

1987	Macintosh II and Macintosh SE released, and IBM's successful PS/2 Systems machines	The new version of Vokswriter Deluxe Plus has spell-check. ButtonWare offers their word-processing program, PC-TYPE, with an integrated style-checker, PC-STYLE (allowing a writer to calculate on the run number of sentences and words, words per sentence, percent of long words or personal words or action verbs, syllables per word, and readability level—all rated from "poor" to "best"). Eric Johnson markets StrongWriter

• Barlow, Michael. (1987). Working with computers: Computer orientation for foreign students. ERIC Document Reproduction Service, ED 286 478. *instruction, ESL, international, computer-analysis, style-checker, WordStar, EMACS, MacWrite, word-processing*
• Borthick, A. Faye; Ronald L. Clark. (1987). Improving accounting majors' writing quality: The role of language analysis in attention directing. Issues in Accounting Education 02.1, pp. 13-27. *accounting major, instruction, data, computer-analysis, style-checker, grammar-checker, self-evaluation*
• Burns, Hugh. (1987). Computers and composition. In Tate, Gary (Ed.), Teaching composition: Twelve bibliographical essays; Fort Worth, TX: Texas Christian University Press, pp. 378-400. *review of research, computer-analysis, style-checker, bibliography*
• Craven, Jerry. (1987). A ready and easy way to establish an (almost) free computer-assisted composition course. Computer-Assisted Composition Journal 02.1, pp. 1-3. *computer-analysis, style-checker, RightWriter, CAI, instruction*
• Hawisher, Gail E. (1987). The effects of word processing on the revision strategies of college freshmen. Research in the Teaching of English 21.2, pp. 145-159. *computer-analysis, word-processing, revising, instruction, experiment, contrast-group, data*
• Huffman, Donald T.; John R. Goldberg. (1987). Using wordprocessing to teach EFL composition. System 15.2, pp. 169-175. *word-processing, ESL, EFL, spell-checker, computer-analysis, computer-feedback, format, instruction*

- Hull, Glynda; Carolyn Ball; James L. Fox; Lori Levin; Debora McCutchen. (1987). Computer detection of errors in natural language texts: Some research on pattern matching. Computers and the Humanities 21.2, pp. 103-118. *computer-analysis, natural language, error-detection, accuracy, validity, data*
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- Lawrason, Robin A. (1987). Writer's Workbench: An English language software program that works. Journal of Educational Techniques and Technologies 20.2, 17-23. *Writer's Workbench, CAI, computer-analysis*
- Little, Sherry Burgus. (1987). The computer as audience: Using HOMER, a text analysis program. Computers and Composition 4.2, pp. 106-120. *computer-analysis, style-checker, text-analysis, HOMER, miscommunication, false flag*
- McCleary, William J. (1987). Evaluating student papers with a word processor: A progress report. Research in Word Processing Newsletter 05.3, pp. 9-15. *response, instruction, commenting, computer-analysis, error, Volkswriter*
- McDaniel, Ellen. (1987). Bibliography of text-analysis and writing-instruction software. JAC: Journal of Advanced Composition 07.1-2, pp. 139-171. *text-analysis, computer-analysis, CAI, bibliography, survey, software*
- Mitton, Roger. (1987). Spelling checkers, spelling correctors and the misspellings of poor spellers. Information Processing & Management, 23.5, pp. 495-505. *computer-analysis, spell-checker, workplace, data*
- Morgan, Bradford A. (1987). From word processing to desktop publishing and CD ROM: A five-year bibliographic

perspective on the impact of computers on writing and research. Research in Word Processing Newsletter 05.5, pp. 2-42. *computer-analysis, word-processing, bibliography, [375+ items]*

• Oates, William R. (1987). Style analyzers inspire rewriting despite limits. Journalism Educator 42, pp. 44-45. *computer-analysis, style-checker, revising, journalism course*

• Pedersen, Elray L. (1987). The effectiveness of Writer's Workbench and MacProof. ERIC Document Reproduction Service, ED 281 231. *computer-analysis, MacProof, Writer's Workbench, accuracy, data, style-checker, grammar-checker*

• Pfaffenberger, Bryan. (1987). Integrated word processing software: Has it arrived? Research in Word Processing Newsletter 05.2, pp. 10-11. *word-processing, computer, computer-analysis, style-analysis, CD-ROM, PC-TYPE, PC-STYLE, ButtonWare*

• S. I. Newhouse School of Public Communication, Syracuse University (Ed.). (1987). Mightier than the typewriter: A report on using the computer to teach writing for the mass media. ERIC Document Reproduction Service, ED 289 163. *computer-analysis, style-checker, spell-checker, instruction*

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1988	First successful optical chips, which boost processing speed.	Spinnaker Software sells Better Working Word Publisher, software aimed at the business world, for the Commodore 64, including a 100,000-word spell-checker. Merle Tenney of Lexpertise Linguistic Software helps develop MacProof for languages other than English	

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| 1989 | World Wide Web invented by Tim Berners-Lee. Intel releases its 80486 DX, which could run at 25 MHz—later versions would quadruple this performance | Microsoft Word 4.0 introduced, with built-in word count and spell-checker. PenPal and Scribble! are now available for Commodore's Amiga personal computers, containing 100,000+ vocabularies for spell-checking and 400,000+ thesauri. The grammar-checker Critique is now available for IBM machines, identifying over 150 types of errors and suggestions for better phrasing and including a readability index | First issue of the Journal of Computing in Higher Education | • Burnett, Henry J. (1989). Five centers model: Integrated labs for instructional technology and student assessment. Community and Junior College Libraries 06.2, pp. 17-23. *computer-analysis, placement, validity, instruction, pre-post, data*
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Assisted Composition Journal 04.2, pp. 55-67. *computer-analysis, Grammatik, style-checker, RightWriter, accuracy, data*

• Wainer, Howard; Neil J. Dorans. (1990). Computerized adaptive testing: A primer. Hillsdale, NJ: Erlbaum. *assessment, computer, machine-scoring*

| 1991 | Linus Torvalds offers free his operating system, Linux | WordStar purchases Lifetree Software's Correct Grammar. MacWord 5.0 includes a grammar-checker (which often crashed when opened). There are now many stand-alone grammar-checkers for DOS and Windows, including Reference Software's Grammatik, Artificial Linguistic's PowerEdit (acquired by Oracle in 1993), Eric Johnson's StrongWriter, Lifetree's Correct Grammar, Que Software's RightWriter, Avalanche's ProofPositive, McGraw-Hill's Edit!, Sensible Software's Sensible Grammar, and Systems Compatibility's Writer's ToolKit |

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• Miller, Lance A. (1991). Computers for composition: A stage model approach to helping. In Steinberg, Erwin Ray (Ed.), Plain language: Principles and practice; Detroit, MI: Wayne State University Press, 93-123. *plain-English, computer-analysis, stage-model*

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- Simkin, Mark G. (1991). Using grammar checking software. Technical Communication 28, pp. 376-377. *computer-analysis, style-checker, grammar-checker, technical communication, instruction*
- Starr, Douglas. (1991). Using word processor to evaluate student papers benefits student and instructor. Collegiate Microcomputer 09.1, pp. 55-58. *computer-analysis, commenting, paperload*
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1992

Microsoft Word 5.0 marketed, with the first integrated grammar-checker. It was not automatically installed, in part because the package was a memory hog. Bruce Wampler sells his Grammatik software to Word Perfect. WordStar 1.5 offers Correct Grammar for Microsoft Windows,

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- Greenia, George D. (1992). Computers and teaching composition in a foreign language. Foreign Language Annals 25.1, pp. 33-46. *computer-analysis, style-checker, grammar-checker, ESL, grading*
- Harmon, Jean. (1992). Say it write! Word Perfect: The magazine (August), pp. 68-72. *computer-analysis, style-checker, grammar-checker, WordPerfect, accuracy, data*
- Hart, Robert L. (1992). An investigation into the effects of computer word processing utilization on the writing skills of students at Gloucester County College. ERIC Document

but machines need an additional 1.6 MB to handle it

Reproduction *computer-analysis, style-checker, grammar-checker, two-year, gain, instruction, pre-post, holistic, co-authoring* Service, ED 343 155.

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• Kucera, Henry. (1992). The odd couple: The linguist and the software engineer: The struggle for high quality computerized language aids. In Svartvik, Jan (Ed.), Directions in corpus linguistics: Proceedings of Nobel Symposium 82, Stockholm, 4-8 August 1991 (pp. 401-420). Berlin: Mouton de Gruyter. *computer-analysis, spell-check, grammar-check*

• Nimersheim, Jack. (1992). Grammar checker face-off. Home-Office Computing 10.7, pp. 48-53. *microcomputer, workplace, grammar-checker, computer-analysis, Grammatik, Correct Grammar, Power Edit, accuracy, data*

• Pearlstein, Gloria. (1992). Performance without training: How to improve your writing by using an automated grammar/style checker. Performance and Instruction 31.9, pp. 32-34. *style-checker, grammar-checker, machine-analysis*

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• Rieber, Lloyd. (1992). Grammar rules as computer algorithms. College Teaching 41.2, pp. 57-59. *computer-analysis, grammar-check, algorithm, passive, rules*

• Roy, Emil. (1992). Evaluating placement exams with a structured decision. Computers and Composition 9.2, pp. 71-86. *placement testing, computer-analysis, RightWriter, correlation, human-machine, data, style-checker*

• Roy, Sandra; Emil Roy. (1992). Direct mail letters: A computerized linkage between style and success. Journal of Business and Technical Communication 6, pp. 224-234. *computer-analysis, letter-writing, evaluation*

• Rude, Carolyn; Elizabeth Smith. (1992). Use of computers in technical editing. Technical Communication 39.3, pp. 334-342. *computer-analysis, workplace, technical communication, survey, editor-opinion, data*

• Smith, Jan. (1992). Mark your words with grammar checking software. PC Computing (October), pp. 243-251. *computer-analysis, grammar-checker, accuracy, data*

• Strickland, James. (1992). An annotated bibliography of representative software for writers. Computers and Composition 9.1, pp. 25-35. *grammar-checker, style-checker, bibliography, software*

| 1993 | Intel Pentium released, achieving new levels of MIPs. World Wide Web becomes public and free and use burgeons, | WordPerfect 5.2 for Windows adds a grammar-checker | • Brock, Mark N. (1993). A comparative study of computerized text analysis and peer tutoring as revision aids for ESL writers [dissertation]. Indiana, PA: Indiana University of Pennsylvania. *ESL, revising, improvement, peer-tutoring, computer-analysis, style-checker, audience, accuracy, data*
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especially since commercial providers were allowed to sell their services to individuals

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• Giles, Timothy D. (1993). Ideas in practice: The search key as a grassroots grammar checker. Journal of Developmental Education 16.3, pp. 28-31. *computer-analysis, search-and-find, word-processing, grammar-checker, proofreading, strategy, comma, sentence-fragment, student-opinion*

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• Liou, Hsien-Chin. (1993). Investigation of using text-critiquing programs in a process-oriented writing class. CALICO Journal 10.4, pp. 17-38. *computer-analysis, Grammatik, ESL, feedback, peer-editing*

• March, Thomas A. (1993). Computer-guided writing: Developing expert characteristics in novice writers. ERIC Document Reproduction Service, ED 366 983. *computer-analysis, CAI, grammar-checker, style-checker, instruction*

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• Pennington, Martha C. (1993). Computer-assisted writing on a principled basis: The case against computer-assisted text analysis for non-proficient writers. Language and Education 07.1, pp. 43-59. *computer-analysis, style-checker, grammar-checker, basic writer, accuracy, feedback, revising*

• Rahmstorf, G.; R. Rabinovitz. (1993). Better writing through electricity. PC Magazine (May), 147-200. *accuracy, Correct Grammar, Grammatik, RightWriter, CorrecText*

• Roy, Emil L. (1993). Computerized scoring of placement exams: A validation. Journal of Basic Writing 12.2, pp. 41-54. *placement, machine-scoring, electronic-grading, computer, validation, prediction, data, machine-analysis, RightWriter*

• Schramm, Robert M. Grace E. Rich. (1993). CAI vs. textbook for grammar and punctuation skills. Business Education Forum 47.4, pp. 48-52. *machine-analysis, style-checker, grammar-checker, punctuation, CAI*

• Starr, Douglas. (1993). Paper grading on single disc preferable to multi-disc way. Community College Journalist 21.3, pp. 4-6. *practice, response, commenting, machine-scoring, computer-analysis, grading, Texas A&M University, journalism-course*

• Williamson, Barbara L. (1993). Writing with a byte: Computers—an effective teaching methodology to improve freshman writing skills. ERIC Document Reproduction Service, ED 362 245. *revising, computer-analysis, Writer's Helper, verb, stative, improvement, student-opinion, data*

• Wresch, William. (1993). The effect of writing process software on student success: A research summary. Journal of

Computing in Higher Education 05.1, pp. 102-110. *computer-analysis, word-processing, basic, instruction, gain, review-of-research*

- Wresch, William. (1993). The imminence of grading essays by computer--25 years later. Computers and Composition 10.2, pp. 45-58. *computer, computer-analysis, evaluation, machine-scoring, history*

1994	Iomega markets the Zip drive, with 100 MB storage cartridges. Netscape Navigator 1.0 released.	Microsoft Word 6.0 introduces an AutoCorrect function

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- Rabinovitz, Rubin. (1994). Grammatik 6.0 misses as many errors as it finds. PC Magazine 13.15, pp. 50. *computer-analysis, grammar-checker, Grammatik 6, accuracy, data,*

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Page activated October, 2005