
MOSAIC: A Model for Technologically Enhanced Educational Linguistics

This paper is an exploration into the intersection of applied linguistics, media applications, and information science, the convergence of which results in technologically aided language teaching. General linguistics has employed taxonomic procedures for several decades yet has overlooked the computer's ability to aid in organizing, storing, and retrieving the massive information for research as well as instruction. In the near future, information technology will make possible electronic information storage repositories capable of integrating voice, image, and data. The management and orchestration of this information in novel designs can serve to radically reform approaches to developing and implementing instructional curricula. The author advances a model for educational linguistics that utilizes technology as a platform to incorporate an expansive data base open to a wide range of users and guided by expert systems. The model is a multi-dimensional ordered system for associative integrative consultation (MOSAIC).

The Computer As Drill Master Reexamined

Aided by the proliferation of the personal computer, the utilization of Computer Assisted Language Learning (CALL) primarily for drill and practice has gained moderate support throughout this decade. Yet, methodologists continue to take CALL to task as expensive and inefficient, a fundamentally behavioristic, even anti-humanistic, anachronism. This perception is not without certain justification, for traditional CALL does little to further communicative competence, the central concept attracting

theoretical research and practical concern in foreign and second language education since the mid-seventies.

Against this current status, indications now abound that utilization of the computer as drill master is being reevaluated by educators in order to expand the role of the computer. Wyatt (1987), for instance, identifies the computer's "facilitative" function which frees students to act as the initiators of their learning and provides for learning objectives and paths not specifically directed by a computer program. Likewise, Phillips (1987) identifies a "prosthetic role" for the computer, suggesting that a computer aiding brain power is analogous to a lever assisting human muscle.

Recent statistical evidence further substantiates the computer's changing profile in learning applications. In a survey of personnel in 18 CALL projects throughout Great Britain, Canada, and the U.S., Ng and Olivier (1987) report that a majority of respondents perceive that of all its designated purposes, the computer serves best as a provider of resources.

As the computer's potential within language teaching is debated, successful models of computer utilization from other fields invite application to CALL. Relational data bases—commonly employed in such information-intensive fields as business, medicine, and law—depend on the explicit expression of expansive data fields in highly structured frameworks. Analogously, descriptive and applied linguistics have relied upon hierarchic indexing of information in taxonomies for several decades. Computer mediation to facilitate data organization and manipulation, however, remains virtually unexplored.

Taxonomy

Agreement upon the utility of accepted nomenclature and outline of boundaries and system fields is fundamental to scientific study. Taxonomy and typology address the definition of components and the systematic arrangement of elements within a given discipline. Categorization of the selected elements often assumes the form of hierarchies of superior and subordinate groups. Taxonomic ordering, which on the surface appears as a matter of convenience, can suggest subtle relationships and complex hidden structures among the elements.

Although originally the exclusive province of the applied scientist, taxonomy or classification techniques have also proved essential for educators in the humanities (Bloom and Kratwohl 1956, 1964). Among methodologists committed to the audio-lingual approach, the application of taxonomic classification procedures found substantial support. The influential texts of foreign language pedagogy of that time featured extensive and systematic inventories of drills (Brooks, 1960; Lado, 1964; Rivers, 1968). A number of studies appeared in the professional literature utilizing the expression of detailed cataloguing of exercises. Dodson (1967) proposed an exercise typology employing a two-axis matrix, plotting drill types (imitation, substitution, extension, completion, question and answer, and global) against stimulus type (verbal, written, pictorial, graphic, audio-visual, and physical object). Such a framework was capable of generating over 300 different exercises. Paulston's (1970) proposal for graduating structural pattern drills from simple mechanical to communicative also resulted in a comprehensive drill inventory developed through the use of formal classificatory procedures.

As language teaching methods gradually shifted focus from teacher actions to student behavior, investigations of drill typologies yielded a concern for what a LEARNER must verbally DO to confirm the teaching-learning cycle. Thus, Lee's (1972) taxonomy of 44 behavioral objectives reaffirms the continuing influence of hierarchic structuring within applied linguistics. The culmination of taxonomic expression within a behavioral framework is achieved in the extensive

inventories and matrices developed by Valette (1971) and Valette and Desick (1972) which cross-tabulated subject matter, cognitive and psychomotor skills as well as affective factors. Taxonomy also found applications in course design and specification of instructional materials for teacher training, exemplified in the recommendations of proponents of the "systems approach," to instructional design. (Banathy and Lange, 1972; Tuman and Brisley, 1981).

The role of taxonomic inventory permeates structural linguistics and its extension into teaching methods. With the eclipse of behavioristic methods, taxonomic procedures survive and are amplified by functionalism which has effected syllabus design since the early 1970's. Despite historical shifts of emphasis within applied linguistics, taxonomy continues independently of methodological trends.

Recent descriptions of syllabus design indicate leanings toward task-based and process syllabuses. These new designs incorporate the pragmatic and communicative aspects of functionalism without losing sight of the pedagogic interpretations of the formal aspects of language. Furthermore, the subordination of method to content, characteristic of functionalism, is yielding to increased attention to active purposeful instruction. A more interventionist role for methodology is evolving within the process syllabus, increasing the learner's pivotal role in the instructional process and encouraging negotiations between teachers and learners concerning what they may jointly work on and achieve together (Breen, 1987a & b).

The intent to incorporate features of earlier perspectives on methodology and syllabus design necessitates the combination of many descriptive and methodological features in ordered arrays. Established taxonomic procedures in conjunction with computer data base applications can be instrumental in structuring such massive collections of data. This process can be substantially enhanced by the computer's facility in manipulating data and providing multiple configurations and trial solutions pertaining to the integration of language components and teaching methods.

MOSAIC

The proposed model is put forward as an information tool for language research, teaching, and learning. The structure and process of the system appearing in Figure 1 has been dubbed MOSAIC, a multi-dimensional ordered system for associative integrative consultation.

The central core of MOSAIC encompasses the areas of language description, curriculum design, and teaching methodology. Expert systems (ES)

bind the information within the knowledge base and guide the direction of queries. MOSAIC's perimeter ring represents the range of users and implies the continuously interactive relationships between them and the information requested. In operational terms, MOSAIC is an Information Center which provides answers to questions posed as well as being an expansive interrelational data base. Networks of linked workstations share access to a central data bank which distributes information at a level of specificity appropriate to the user's needs.

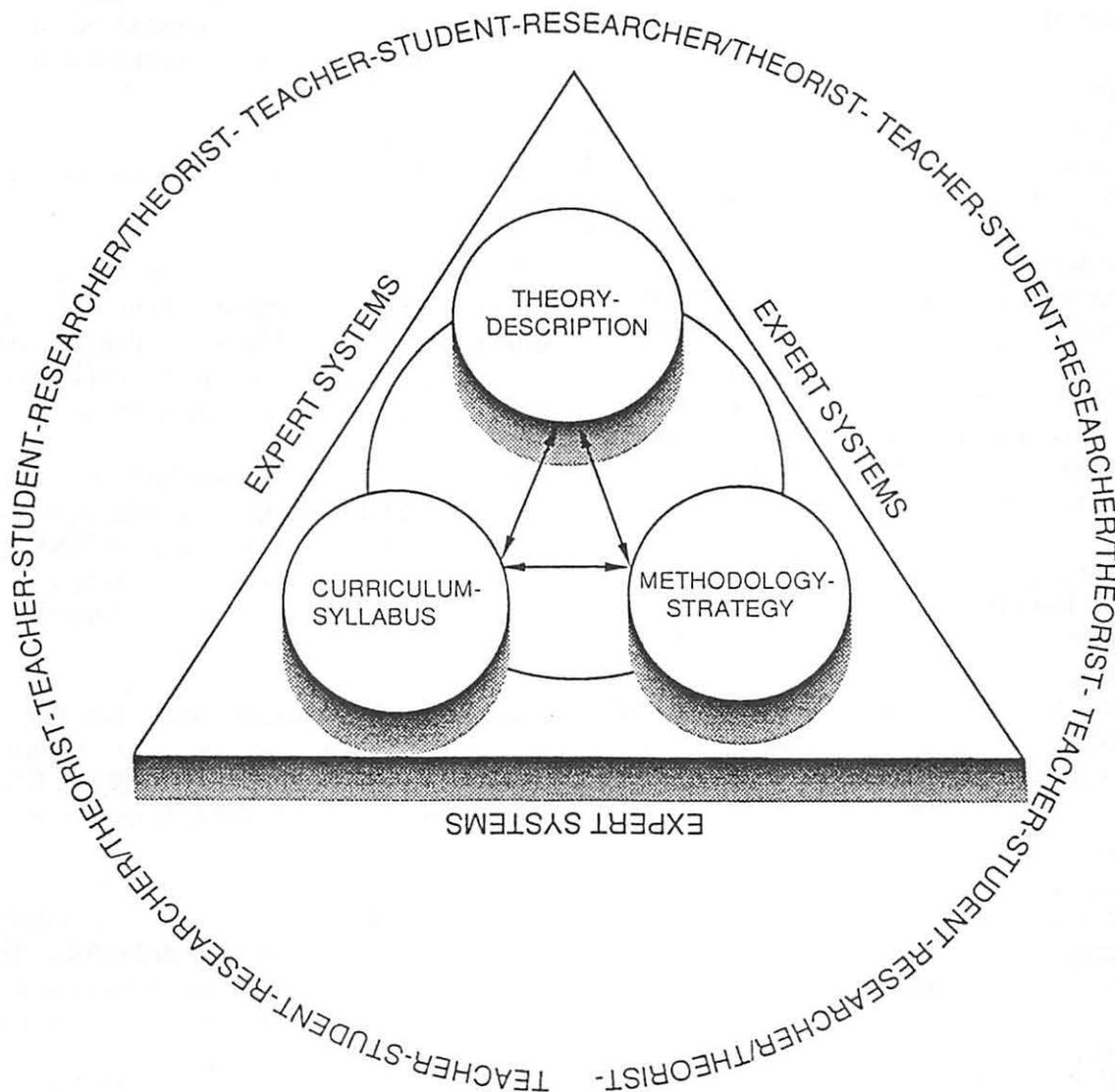


Figure 1. Architecture of MOSAIC

Multiple Information Seekers

Due to storage and distribution limitations imposed by the print medium, information bearing on all aspects of learning, teaching, and research is compartmentalized. Specifically, large quantities of information that an instructor or researcher keeps for personal reference may well benefit the curious student wishing to peruse the field. MOSAIC recommends the dissolution of knowledge barriers to provide comprehensive information pools for all those involved in language teaching-learning. With electronic data storage capacity increasing exponentially and the sophistication of data searching improving rapidly, access to previously unimaginable types and quantities of information becomes feasible.

In traditional instruction, students are typically grouped lock-step with few means and little encouragement to explore language grammar and expression beyond immediate and narrowly defined goals. Course plans and the lack of convenient reference sources restrict student initiative and self-motivated inquiry. MOSAIC delivers to the learner not only the texts and tapes—in digitized form—but also a wide range of CALL upon request. Therefore, traditional linear instruction is enhanced by complementary activities at workstations featuring online glossaries, pedagogical grammars, and wide-ranging audio and video resources. Learners gain the novel perspectives of self-directed and self-access learning and the generalized availability of such information banks democratizes the learning process. Additionally, as Noblitt (1988) points out, when master and pupil share equal access to all instructional information, a mutually supportive peer relationship develops.

Similarly, the instructor is restricted by the inefficiency of print media for the required reference volumes, syllabuses, and instructional materials. The utilization of electronic storage for such resources and their distribution via telecommunications networks is economical and viable as demonstrated by some recent efforts in applied information management. Carnegie Mellon University and the Online Computer Library Center (O.C.L.C.) have announced collaborative efforts to design "Mercury," an electronic library intended to furnish the scholar's

desk with seventeen million records traditionally accessible only at major university facilities. A related development is the currently functioning National Science Foundation computer network which passes information among six super-computer centers and researchers at nearly 200 universities. It is able to transmit 1.5 million bits of information each second, the equivalent of 50 pages of single-spaced typewritten text.

The coming expansion of networking services is recognized by Buller (1988) who describes a classicist's "online forum" for improved access to each other as well as to a variety of materials for teaching and research. His specifications represent desirable components for the data base and are reproduced in some detail because of their insight and potential application to the design of MOSAIC.

Buller Specs as Desirable Components of MOSAIC

Sample course syllabi, outlines, classroom materials and bibliographies; items included in generic machine-readable form so that adaptation to a particular program can be implemented without extensive retyping or revision.

Material that in print form becomes rapidly outdated: **updates of ongoing research projects**, lists of available **grants and fellowships**, schedules of **conferences and lectures**, ranks and addresses of classicists, **employment information**.

Relevant field-specific texts that may be searched automatically, eg., the American Philological Association's Repository of Greek and Latin Texts, downloadable computer programs for education and research.

Scholarly papers (to be studied and improved prior to print form), **reviews and information** about book availability to effect speedier diffusion of research materials, notices of archaeological discoveries.

Frischer (1988) reports on the evolution of yet another data sharing project inviting emulation within MOSAIC. The UCLA Classicists Workbench focused on classical Greek literature is a

distributed computing network providing students with lexical information tied to a corpus as well as background factual notes and bibliography. For the scholar, the various data bases are capable of concordance-like searches and support bibliographic expansions describing current literature relating to selected texts. Workstations communicate with a minicomputer that stores information on a pair of 470 megabyte hard disks. Plans are underway to expand the data base by integrating videodisc technology, thereby offering a visual dimension to the classical topics represented.

The Workbench concept delivers primary and secondary sources promoting traditional scholarship and research. On the other hand, CALL materials as suggested by Garrett and Hart (1989) are in themselves an incomparable psycholinguistic research tool, providing a means to chronicle user-materials interaction. They are nonintrusive to the learning process and extensive record keeping facilities monitor student progress through learning sequences, track paths of grammatical inquiry, monitor success-failure rates, and observe student hypothesis testing tactics. Furthermore, students are encouraged to record spontaneously marginal comments and impressions as they complete CALL exercises. Thus, MOSAIC's role in delivering instructional materials and testing instruments can open windows into interlanguage development and offer extensive empirical data for investigating language learning.

Expert Systems

Expert Systems (ES) are a direct descendant of the discipline of artificial intelligence which attracted vigorous research in the late 1950's. Yet, current ES proponents forego attempts to fathom the depths of human reasoning patterns in terms of "relevance," "context," and "situational background." The function of ES, simply put, is to utilize computer mediation within limited knowledge domains with the goal of aiding decision making. These mediations characteristically transcend the low-level data manipulations of applications in computer science and attempt to mimic human performance, as in the widely cited MYCIN program for diagnosing infectious blood diseases (Shortliffe, 1976).

The computer's diagnostic ability in error correction as an intelligent tutor and its capacity to direct student progress are both components of ES that have attracted the attention of educational researchers (Yazdani, 1987; Ohlsson, 1987). Turning to ES application in language learning, Bailin and Levin (1989) identify the following issues as principal concerns: natural language processing, computer models for teaching and learning, intelligent tutoring systems, CALL materials types, microworlds, and ES. Especially relevant is their reference to the lack of ES utilization in intelligent CALL, in light of the overwhelming popularity of this tool in many other disciplines.

Consequently, the application of ES to educational linguistics is not so much controversial as underexplored. Sussex (1989), for instance, identifies the role of ES in intelligent CALL as twofold: tutorial-managerial and authorial. This latter function, he maintains, holds considerable promise in supporting the design of intelligent CALL lessons by inexperienced computer users. The EXCALIBUR Project at Deakin, La Trobe, and Melbourne Universities is formally investigating the viability of lesson authoring environments facilitated by ES. Nyns (1989: 46), on the other hand, expresses pessimism regarding the implementation of ES to CALL. He cites the Winograd and Flores (1986) argument that concerns the inadequacy of natural language parsing and interpretation in coping with the reactive aspects of language. He does allow for the viability of "mini expert-systems," used, for example, in the case of teaching reading skills where restricted domains are represented.

The fundamental role of ES within MOSAIC is directive. In exercising decision aiding, ES scan the knowledge base and determine appropriate entry points required to respond to a particular query. ES also route inquiries from information seekers through relevant channels permitting the output to fit the level of inquiry. For example, when a student requires information on some aspect of inflection, ES organize the response to incorporate fundamental grammatical rules, practical examples, and clarifications. Logical and consistent organization of nested information is a key factor in the successful implementation of such complex and reciprocally related

information. Inquiries may be conducted either in a dialogue-interactive fashion or in report format. Critical to the successful output of the system is the simplicity and efficiency of the "navigation" rules adopted within the system as well as the sensitivity of the responding instrument to provide appropriate feedback.

Knowledge Base

The data at the core of the MOSAIC system constitutes three discrete yet interrelated fields: Theory-Description; Curriculum-Syllabus; and, Methodology-Strategy. A recurrent taxonomic thread loosely binds the component infrastructure. This proposed trichotomy is put forward more in the spirit of an hypothetical construct rather than as a working model. Elements of information included in the fields ideally would appear on a continuum, where form, linguistic and communicative criteria can be reconciled (Shaw, 1977). New approaches toward instructional design advocate the integration of syllabus components with teaching methodology. For instance, Higgs (1985: 11), in promoting a syncretism of language learning and acquisition, comments on the relationship of linguistic structures to instructional tactics. He hypothesizes a "hierarchy of instructional tactics," whose purpose is "to match certain perceived characteristics of linguistic elements—most especially the extent to which the relationship between their form and the meanings they communicate is transparent and explicit—with compatible instructor behaviors." Such interplay of language form and teaching methodology invokes linguistic analysis involving a multiplicity of variables bound together in an intricate network. The computer's ability to juxtapose data in manifold configurations prompts investigations of this order to explore the relationship among language theory, curricular design, and instructional methods and materials.

Theory-Description

Under this rubric, MOSAIC data approximate the assembly of taxonomic linguistics. Formal descriptions include primarily synchronic detail, reflecting social and discursive properties, accounting for language both as medium and message. Prominent and competing linguistic

models depicting phonology, syntax, and semantics might well serve initial investigation. For example, typical data contained in this field might be drawn from applied semantics, an area that utilizes the computer's ability to inventory and categorize lexical features.

Two lexicographic projects appear applicable within this MOSAIC field both as theoretical prototypes and as practical tools for student use. The Bonnlex Lexicon System (Brustkern and Hess, 1982), devised as a machine-readable data bank relating terminologies, lexical data and grammatical models to one another, is especially pertinent to machine translation. The Melcuk and Zholkovsky *Explanatory Combinatorial Dictionary of Russian* (1984) is primarily a lexicographic tool for linguists that—according to the compilers—has applications for textbooks, pedagogically oriented dictionaries, and reference works.

MOSAIC facilitates access to such lexicographic studies in order to enhance the typically controlled and circumscribed student interaction with course materials. For all those involved in the process of language description, course design, and teaching, the availability of an encyclopedic perspective on lexis, for instance, may radically expand all aspects of language study and research.

Curriculum-Syllabus

This field—more so than either of the contiguous ones—is integrative, bridging Theory-Description with Methodology-Strategy. Its most typical contents include functional components, especially relevant for curriculum development, expressed taxonomically. Here the MOSAIC model's special concern is with the communicative aspects of language rather than its formal description. Syllabus design theory has exerted considerable influence on educational linguistics for more than a decade focusing on sociological and psychological dimensions of language "use," rather than "usage." Since Theory-Description primarily stresses linguistic content, Curriculum-Syllabus adjusts it to reflect more individualized needs, incorporating the broadest possible interpretations of discourse and the many communicative categories used to describe it.

However, the Curriculum-Syllabus field's mediating influence necessitates the inclusion of transitive and overlapping elements. Therefore, a particular lexical item may co-occur as an example of a phonological principle (Theory-Description), and as a functional element at another point of analysis (Curriculum-Syllabus). As is typical of items expressed in reciprocally related data bases, elements contained in divergent parts of the knowledge base can be subjected to diverse grouping and combinations depending on the nature of the inquiry.

The infrastructure of Curriculum-Syllabus could tentatively utilize a number of frameworks applicable to curricular planning. For example, the feature analyses proposed by Bosco and Di Pietro (1970) and by Krashen and Seliger (1975) highlight a wide range of useful categories. The seminal study of van Ek (1975) and the English language syllabus of Munby (1978) offer considerable guidance and operational prototypes for framing a syllabus. Especially pertinent for theoretical insights in categorization are Wilkins' (1976) taxonomy and the communicative categories developed by Widdowson (1978).

Stern (1983) notes a number of model foreign language syllabuses relevant to planning French (Coste et al., 1976); Spanish (Slagter, 1979); and, German (Baldegger et al., 1980). Also containing elements of specific interest for Russian and Italian respectively are the syllabuses of Beljakova (1978) and de' Paratesi (1981).

Methodology-Instructional Strategy

Assembled under this label are the broadest and most ephemeral elements for user access. The information contained relates primarily to teaching-learning and to all aspects of the implementation of instruction. Available for consultation at upper taxonomic levels are traditional bibliographical sources for perusal as well as texts and teaching tools. Major methodological handbooks for teacher training provide a useful framework for organizing elements to be included and for representing a wide range of teaching approaches and methodological affiliations. Examples of highly structured materials and resources appropriate within MOSAIC are Candlin's (1981) exercise typology and Grellet's

(1981) taxonomy for the structuring of reading comprehension. Handbooks for practical teaching exercises are also to be considered for inclusion as typified by Allen's (1983) *Techniques in Teaching Vocabulary*.

A continuously expanding list of useful classroom tools finds expression in Methodology-Instructional Strategy as well. Some notable examples are Birckbichler's *Creative Activities for the Second Language Classroom*, Lee's *Language Teaching Games and Contests*, and Wright Betteridge, and Buckby's *Games for Language Learning*. Many informal motivational aids for classroom use—traditionally available as local publications—can be distributed through networking. Bibliographies, as exemplified by Walz' (1988) guide for sources of activities to promote oral proficiency, are timely resources that could enjoy wide distribution through MOSAIC.

Technical Specifications

As hypothetical model, MOSAIC stretches the current boundaries of technological viability. Its successful implementation as a pragmatic entity requires complex information management complemented by computer and media-related systems merely hinted at by their contemporary exemplars. Presently, the storage of voice, data, and image in a unified, easily accessible format has not been realized. Furthermore, the memory requirements and delivery capacity of the described Information Center exceed the capabilities of currently available personal workstations. Yet, new storage technologies progress rapidly, and CD-ROM, for instance, (with an archival capacity approximately the equivalent of 1,500 floppy disks or more than 270,000 pages of typewritten text) will likely survive as an ancient progenitor. Optical disks, too, have gained acceptance in business and industry and offer advantages in certain applications. A generic twelve-inch optical platter stores approximately 2.3 gigabytes (one gigabyte equals one billion bytes or 1,000 megabytes). Two billion bytes is equal to 80 file cabinets. Optical disk "juke boxes" store 280 gigabytes of information and provide access to a specific document within seven to ten seconds. The desktop "online virtual library" is clearly within

reach, especially in light of recent reports alluding to magneto-optical media capable of storing 1,000 gigabytes.

Conclusion

The form and process of MOSAIC may be summarized by stating the following characteristics essential to its design and implementation: 1) ordered, expressed in taxonomic format; 2) receptive of information in diverse formats such as video, image, data; 3) user-controllable, requiring minimum training; 4) cumulative, successfully gaining in timely information; 5) expansive, accepting an extremely large amount of data; and, 6) nonprescriptive, option-serving.

The taxonomic arrangement of language description and communicative objectives in contraposition with an inventory of instructional techniques, strategies, and teaching activities is, indeed, a formidable venture. Without the aid of a computer, any such categorization is impractical, perhaps, unthinkable. MOSAIC is offered as a means of exploring such interactions with a view toward task-based and process syllabus design. The application of information management strategies enhanced by ES are invoked within the MOSAIC model to integrate data structures and assure a viable information delivery vehicle. Ultimately, it is hoped that the MOSAIC model suggests computer utilization as part of a larger plan where technology supports all levels of educational linguistics.

References

- Allen, V.F. (1983). *Techniques in teaching vocabulary*. New York: Oxford University Press.
- Bailin, A. & Levin, L. (1989). Intelligent computer-assisted language instruction. *Computers and the humanities*, 23, 3-11.
- Baldegger, M. Muller & Schneider, G. (1980). *Kontaktschwelle Deutsch als fremdsprache*. Strasbourg: Council of Europe.
- Banathy, B.H. & Lange, D.L. (1972). *A design for foreign language curriculum*. Lexington, MA: D.C. Heath & Co.
- Beljakova, N.N. et al. (1978). *Ucebni russskogo jazyka dlja nefilologiceskix vuzov SSSR. Practiceskaja grammatika*. Moscow: Russkij jazyk.
- Birckbichler, D.W. (1982). *Creative activities for the second language classroom*. Washington, D.C.: Center for Applied Linguistics.
- Bloom, B.S. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain*. New York: David McKay.
- Bosco, F.J. & Di Pietro, R.J. (1970). Instructional strategies: Their psychological and linguistic bases. In Lugton, R.C. and Heinle, C.H. (Eds). *Toward a cognitive approach to second language acquisition*, pp. 31-52. Philadelphia: Center for Curriculum Development.
- Brooks, N. (1960). *Language and language learning*. New York: Harcourt, Brace and World.
- Breen, M.P. (1987a). Contemporary paradigms in syllabus design. *Part I. Language teaching*, 20, 81-92.
- Breen, M.P. (1987b). Contemporary paradigms in syllabus design. *Part II. Language teaching*, 20, 157-174.
- Brosch, G. et al. (Eds) (1977). *Das zertifikat Deutsch als fremdsprache*. Bonn-Bad Godesberg: Deutscher Volkshochschul-Verband: Goethe Institut.
- Brustkern, J. & Hess, K.D. (1982). The Bonnlex lexicon system. In Goetschalckx, J. and Rolling, L. (Eds) *Lexicography in the electronic age*, pp. 33-40. Amsterdam: North-Holland Publishing Company.
- Buller, J.L. (1988) An online forum for the classics. *Computing and the classics*, 4, (Supplement), 1-6.
- Coste, D. et al. (1976). *Un niveau seuil*. Strasbourg: Council of Europe.
- Dodson, C.J. (1967). *Language teaching and the bilingual method*. London: Isaac Pitman & Sons.
- Flores, F. & Winograd, T. (1986). *Understanding computers and cognition: A new foundation for design*. Norwood, NJ: Ablex.
- Frischer, B. (1988). The UCLA classicist's workbench. *Computing and the classics*, 5 (Supplement), 1-4.
- Garrett, N. & Hart, R. (1989). The language lab as research center. Paper presented at the International Association for Learning Laboratories Conference, M.I.T., 1989.
- Grellet, F. (1981). *Developing reading skills: A practical guide to reading comprehension exercises*. Cambridge: Cambridge University Press.
- Higgs, T.V. (1985). Language acquisition and language learning: A plea for syncretism. *Modern language journal*, 69, 8-14.
- Krashen, S.D. & Seliger, H. (1975). The essential contribution of formal instruction in adult second language learning. *TESOL Quarterly*, 13, 573-582.
- Kratwohl, D.R., Bloom, B.S., & Masia, B.B. (1964). *Taxonomy of educational objectives: The classification of educational goals. Handbook 2: Affective domain*. New York: David McKay.
- Lado, R. (1964). *Language teaching: A scientific approach*. New York: McGraw-Hill.
- Lee, R.R. (1972). A taxonomy of second language behaviors. *TESOL Quarterly*, 6, 1-14.
- Lee, W.R. (1979). *Language teaching games and contests*. Oxford: Oxford University Press.
- Melcuk, I.A. and Zholkovsky, A.K. (1984). *Explanatory combinatorial dictionary of modern russian*. Vienna: Wiener Slawistischer Almanach.
- Munby, J. (1978). *Communicative syllabus design*. Cambridge: Cambridge University Press.
- Ng, E.K.L. & Olivier, W.P. (1987). Computer assisted language learning: An investigation on some design and implementation issues. *System*, 15, 17-18.
- Noblitt, J.S. (1988) Writing, technology, and secondary orality. *Academic computing*, 2, 34-35; 56-57.
- Nyns, R.R. (1989). Is intelligent computer assisted language learning possible? *System*, 17, 35-47.
- Ohlsson, S. (1987). Some principles of intelligent tutoring. In Lawler, R.W. and Yazdani, M. (Eds), *Artificial intelligence and education*. Volume 1, pp. 203-237. Norwood, NJ: Ablex.
- Paulston, C.B. (1970). Structural pattern drills: A classification. *Foreign language annals*, 4, 187-193.

- Paratesi de', N.G. (1981). *Livello soglia per l'insegnamento dell'italiano come lingua straniera*. Strasbourg: Council of Europe.
- Phillips, M. (1987). Potential paradigms and possible problems for CALL. *System*, 15, 275-287.
- Rivers, W.M. (1968). *Teaching foreign-language skills*. Chicago and London: University of Chicago Press.
- Shaw, A.M. (1977). Foreign language syllabus development: Some recent approaches. *Language teaching & linguistic abstracts*, 10(4), 217-233.
- Shortliffe, E.H. (1976). *Computer-based medical consultations: MYCIN*. New York: American Elsevier.
- Slagter, P.J. (1979). *Un nivel umbral*. Strasbourg: Council of Europe.
- Stevens, V., Sussex, R., and Tuman, W.V. (1986). *A bibliography of computer-aided language learning*. New York: AMS Press.
- Stern, H.H. (1983). *Fundamental concepts of language teaching*. Oxford: Oxford University Press.
- Sussex, R. (1988). Issues in computer-aided language learning: Towards an expert-systems learning environment. Preliminary Draft. University of Melbourne.
- Tuman, V.W. & Brisley, L. (1981). The development of an exportable foreign language teacher training course. *Recherches et échanges*, 6, 65-95.
- Valette, R.M. (1971). Evaluation of learning in a second language. In Bloom, B., Hastings, J.Y., & Madaus, G. (Eds) *Handbook of formative and summative student learning*, pp. 817-853. New York: McGraw-Hill.
- Valette, R.M. & Disick, R.S. (1972). *Modern language performance objectives and individualization: A handbook*. New York: Harcourt, Brace Jovanovich.
- Walz, J. (1988). *An annotated bibliography for developing oral proficiency in second and foreign languages*. Unpublished Manuscript.
- Winograd, T. & Flores, F. (1986). *Understanding computers and cognition: A new foundation for design*. Norwood, NJ: Ablex.
- Wright, A., Betteridge, D., and Buckby, M. (1979). *Games for language learning*. Cambridge: Cambridge University Press.
- Wyatt, D.H. (1987). Applying pedagogical principles to CALL courseware development. In Smith, W.F. (Ed) *Modern media in foreign language education: Theory and implementation*, pp. 85-98. Lincolnwood, IL: National Textbook Company.
- Yazdani, M. (1987). Intelligent tutoring systems. In Lawler, R.W. & Yazdani, M. (Eds), *Artificial intelligence and education*. Volume 1, pp. 183-201. Norwood, NJ: Ablex.

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