



**KOLEJ SASTERA DAN SAINS
(College of Arts and Sciences)
Universiti Utara Malaysia**

**PERAKUAN KERJA KERTAS PROJEK
(Certificate of Project Paper)**

Saya, yang bertandatangan, memperakukan bahawa
(I, the undersigned, certify that)

ZULHANA BINTI ZULKIFLE
(86005)

calon untuk Ijazah
(candidate for the degree of) **MSc. (Intelligent System)**

telah mengemukakan kertas projek yang bertajuk
(has presented his/her project paper of the following title)

**HYBRID BLEU ALGORITHM FOR STRUCTURED
EXAM MANAGEMENT SYSTEM**

View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Universiti Utara Malaysia: UUM eTheses

(as it appears on the title page and front cover of project paper)

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan
dan meliputi bidang ilmu dengan memuaskan.
(that the project paper acceptable in form and content, and that a satisfactory
knowledge of the field is covered by the project paper).

Nama Penyelia Utama
(Name of Main Supervisor): **PROF. MADYA FADZILLAH SIRAJ**

Tandatangan
(Signature) :  Tarikh (Date) : 10/11/08

Nama Penyelia Kedua
(Name of 2nd Supervisor): _____

Tandatangan
(Signature) : _____ Tarikh (Date) : _____

**HYBRID BLEU ALGORITHM FOR STRUCTURED EXAM
MANAGEMENT SYSTEM**

**A thesis submitted to the Faculty of Information Technology in partial
Fulfillment of the requirement for the degree
Master of Science (Intelligent System)
Universiti Utara Malaysia**

**By
ZULHANA BINTI ZULKIFLE**

**©ZulhanaZulkifle, 2008.
All Rights Reserved.**

Q3
76.9
58X
1446

PERMISSION TO USE	
--------------------------	--

In presenting this thesis in partial fulfillment of the requirement for a postgraduate degree from Universiti Utara Malaysia, I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor or, in her absence, by the dean of the Graduate School. It is also understood that due recognition shall be given to me and Universiti Utara Malaysia for any scholarly use which may be made of any material from my thesis.

Requests for permission to copy or make other use of materials in this thesis, in whole part, should be addressed to:

**Dean of Graduate School,
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman
Malaysia**

ABSTRAK	
----------------	--

Pengajaran dan pembelajaran (P & P) merupakan perkara penting dalam sesebuah pendidikan. Dalam menilai sesuatu P & P, pelbagai teknik penilaian boleh dilakukan seperti kuiz, ujian, amali dan sebagainya. Walaubagaimanapun, apabila sesuatu penilaian telah dibuat, pensyarah2 perlu meruangkan masa bagi menyemak penilaian peralatan tulis ketika metersebut, terutama sekali bagi penilaian berbentuk kuiz dan ujian bertulis. Selain itu juga kekangan kerja sampingan turut menyumbang kepada faktor kesibukan untuk menyemak penilaian-penilaian tersebut. Oleh sebab itu satu sistem yang dinamakan "Hybrid BLEU algorithm for Structured Exam Management System" dibangunkan bagi membantu pensyarah-pensyarah dalam menjalankan penilaian yang berbentuk struktur (kuiz atau ujian). Sistem ini mengaplikasikan algorithm BLEU dalam sistem pakar bagi menyemak jawapan dan memberi markah bagi setiap penilaian yang dibuat. Selain itu juga sistem ini menyediakan sistem pakar bagi menyemak kesalahan ejaan ketika memasukkan soalan-soalan ke dalam bank soalan oleh pensyarah dan ketika menjawab penilaian oleh pelajar. Sistem ini telah diujilari bagi modul Cyberpreneurship di Kolej Komuniti Bandar Darulaman. Seramai dua buah kelas yang berkapasiti 30 orang pelajar telah mencuba untuk menjawab ujian menggunakan sistem ini. Berdasarkan ujilari yang telah dibuat, mereka (pelajar) berpendapat sistem ini sangat mudah digunakan. Sistem ini mempunyai antaramuka yang menarik dan mudah difahami oleh para pelajar. Pelajar-pelajar juga tidak perlu membawa sebarang peralatan tulis ketika mengambil peperiksaan. Walaubagaimanapun, mereka berpendapat sistem ini boleh dibuat dalam dwibahasa memandangkan latar belakang Bahasa Inggeris mereka yang kurang memuaskan. Namun dengan adanya sistem pakar bagi menyemak kesalahan ejaan telah banyak membantu mereka dalam memperbetulkan kesilapan ejaan ketika menjawab penilaian tersebut. Para pensyarah pula berpendapat sistem ini boleh dikemaskinikan lagi dengan merujuk format yang disediakan oleh pihak pengurusan. Sistem ini juga membantu para pensyarah menyemak penilaian yang dibuat dengan lebih cepat dan menjimatkan masa. Secara keseluruhannya, sistem ini berjaya bagi membantu sistem penilaian dalam pengajaran dan pembelajaran di Kolej Komuniti.

ABSTRACT	
-----------------	--

Teaching and learning process is very essential in education. To evaluate teaching and learning process, many techniques can be applied for instance quiz, test, practical and so forth. However, after the assessment has been fulfilled, the lecturers need to spend time to check the assessment especially quiz and written test. Apart from that, other workloads do contribute to this scenario. Due to this problem, "Hybrid BLEU algorithm for Structured Exam Management System" is develop to aid the lecturers during assessment in the construction of quiz and test. This system incorporate algorithm BLEU into the expert system to check the answer and evaluate marks for every assessment. Apart from that, this system consist an expert system to check the spelling error when inserting the question into question bank by the lecturer whilst respond to the student assessment. This system has been conducted for Cyberpreneurship module at Community College Bandar Darulaman. Two classes with thirty students have tested to answer the test using this system. Based on the experimentation, the user (student) concludes that this system is user friendly. It has an attractive interface and easy to be comprehended by students. The students are not required to bring stationary whilst answering the question. Nevertheless, they concluded that this system should be in bilingual in order to take into consideration of the students' proficiency in English language. With the expert system to check the spelling error, can aid them in correcting the error. The lectures believed that this system can be upgraded according to the administration format. As a conclusion, this system has effectively aid the teaching and learning process at Community College.

ACKNOWLEDGEMENTS	
-------------------------	--

First of all, I would like to express my appreciation to Allah, the Most Merciful who has granted me the ability and will power to start and complete this project.

I would also like to express my gratitude to my supervisor, Associate Professor, Fadzilah Siraj, Computer Science Department, Faculty Information Technology at the Northern University of Malaysia for her guidance and advice throughout the completion of this project.

Many thanks to the my friends as a expert for this project from Bandar Darulaman Community College, En Idhwan bin Mohamad, Cik Asmarul Shazila, Pn. Nor Analiza and my diploma students for their helps and supports.

To all my friends that have been helping and supporting me throughout the entire duration of this semester, thank you for your kindness.

And lastly, especially for my beloved husband Mazrul Nizam Mustaffa, my daughters Siti Nur Mardhiah and Siti Nur Fatihah and all my family for your patience and understanding of my responsibilities in completing my post graduate study.

Only God knows everything!

CONTENTS	
-----------------	--

- PERMISSION TO USE** i.
- ABSTRACT (MALAY)** ii.
- ABSTRACT (ENGLISH)** iii.
- ACKNOWLEDGEMENT** iv
- CONTENTS** v
- LIST OF TABLES** viii
- LIST OF FIGURES** ix

- 1.0 INTRODUCTION** 1
 - 1.1 Background 1
 - 1.2 Problem Statements 3
 - 1.3 Objectives 4
 - 1.4 Research Question..... 4
 - 1.5 Scope of Study 5
 - 1.6 Significant of the study 5
 - 1.7 Organization of the report 5

- 2.0 LITERATURE REVIEW** 7
 - 2.1 Computer Assisted Assessment (CAA)..... 7
 - 2.1.1 Advantages of Computer Assisted Assessment (CAA)..... 14
 - 2.2 Information Extraction (IE)..... 15
 - 2.3 Natural Language Processing (NLP)..... 18
 - 2.4 Anaphora Resolution (AR)..... 23
 - 2.5 Latent Semantic Analysis (LSA) 26
 - 2.5.1 Same Application of LSA for free-text CAA..... 27

2.6	Text Categorization Technique (TCT)	29
2.7	Bilingual Evaluation Understudy Algorithm (BLEU)	31
2.8	Expert System.....	35
3.0	RESEACH METHODOLOGY	40
3.0	Introduction	40
3.1	Problem Assessment	41
3.2	Knowledge Acquisition and Analysis	41
3.2.1	Data Modeling	43
3.2.2	Process Modeling.....	44
3.2.2.1	Context Diagram.....	45
3.2.2.2	Level 0 DFD.....	45
3.2.2.3	Level 1 DFD.....	46
3.2.2.4	Exam Questions and Answer.....	46
3.2.2.5	Exam Management.....	47
3.2.2.6	Exam.....	48
3.2.2.7	Evaluation Student Answers.....	49
3.2.3	Logical Data Model of System.....	50
3.2.3.1	Normalization.....	51
3.2.3.2	Structured Exam Management System.....	51
3.2.4	BLEU Algorithm.....	56
3.2.5	Expert System for Similar Words.....	58
3.3	Design and Implementation	64
3.3.1	Design and build the (prototype) system.....	65
3.3.1.1	Build the System Database.....	65
3.3.1.2	Develop the user interface.....	65
3.3.2	Implementation.....	67
3.4	Testing.....	68
3.4.1	Unit Testing.....	68
3.4.2	Integration Test.....	68

3.4.3	Users Testing	69
3.5	Documentation.....	69
3.6	Integration and Maintenance of the System	69
4.0	RESULTS	70
4.1	The Prototype System Architecture.....	70
4.2	Network	71
4.3	Structured Exam management System.....	72
4.3.1	System Registration	74
4.3.2	Administrator Menu	75
4.3.2.1	Function 1; Student Registration.....	76
4.3.2.2	Function 2; Lecturer Registration.....	78
4.3.2.3	Function 3; Admin list and backup/restore data.....	81
4.3.3	Lecturer Menu	83
4.3.3.1	Function 1; Exam Questions.....	84
4.3.3.2	Function 2; Management (Exam Management)	91
4.3.3.3	Function 3; Report.....	95
4.3.4	Student Menu.....	100
4.4	Discussion of Result	108
5.0	CONCLUSION.....	109
5.1	Future Work.....	111
REFERENCES		113
APPEDIX A	USER MANUAL (LECTURER).....	119
APPEDIX B	USER MANUAL (STUDENT).....	125
APPEDIX C	SURVEY FOR STRUCTURED EXAM MANAGEMENT SYSTEM.....	128

LIST OF TABLES

TABLE NO	TITLE	PAGE
2.1	Current existing CAA of free text answers systems	13
3.1	Entities and their attributes before normalization	51
3.2	Exam questions table	53
3.3	Exam management table	54
3.4	Student table	54
3.5	Synonyms table	55
3.6	Lecturer table	56
4.1	Description of functions available in the student's registration window	78
4.2	Description of functions available in the lecturer's registration window	80
4.3	Description of functions for each button in the System Administrator interface	83
4.4	Description of the function for each button in exam questions interface	85
4.5	Description about each function for each button in the exam management	92
4.6	Description about each function available in the Student's report	96

LIST OF FIGURES

FIGURE NO	TITLE	PAGE
2.1	Time line of research in CAA for free-text answers	9
2.2	System Architecture	39
3.1	Knowledge Engineering (Durkin, 1994)	41
3.2	System architecture for lecturers	43
3.3	System architecture for student	43
3.4	The context diagram for system (Environment of system)	45
3.5	Levels 0 that represent primary process	46
3.6	The process of adding / removing / edit exam questions and Answers to /from test banks	47
3.7	Show process for exam management	48
3.8	Show exam processes	49
3.9	Show evaluation student answers processes	50
3.10	Rule based system architecture for similar words	58
3.11	Complete structure of a rule-based expert system	59
3.12	Inference engine cycle via a match fire procedure	60
3.13	Example of an inference chain	62
3.14	Demonstration of forward chaining implemented in the inference engine	62
3.15	Shown knowledge base implementation for similar words	63
3.16	Shows expert system interface for similar words	63
3.17	Generic layout forms uses frame	66
4.1	System architecture for lecturers	70
4.2	System architecture for student	71
4.3	Conceptual network model for system	72
4.4	Hierarchy of interfaces within the overall system	73
4.5	The main screen for Structured Exam Management System	74

4.6	Login screen	75
4.7	Messages for incorrect login user	75
4.8	The main menu for administrator functionality	76
4.9 (a)	The interface to add new student record	77
4.9 (b)	The interface to edit student record	77
4.9 (c)	The interface to delete student record	77
4.9 (d)	The main screen for the student registration	78
4.10 (a)	The main interface for lecturer menu	79
4.10 (b)	The interface to add the lecturer information	79
4.10 (c)	The interface to edit the lecturer information	80
4.10 (d)	The interface to delete the lecturer information	80
4.11 (a)	The main screen for admin menu	81
4.11 (b)	The interface for adding administrator record	81
4.11 (c)	The interface for editing administrator record	82
4.11 (d)	The interface for deleting administrator record	82
4.12	The screen for the backup data	83
4.13	The main menu for lecturer functionality	84
4.14	The main screen for the questions function	85
4.15 (a)	The interface for the add Exam Questions information	86
4.15 (b)	The interface for the add exam questions information with expert system for synonyms	87
4.15 (c)	The expert system for checking error spelling	87
4.16	Flowchart for students answering the exam questions and the process involved	89
4.17	The interface for edit question	90
4.18	The confirm message for delete information	91
4.19	The screen for the exam management	91
4.20	The screen for add new exam management information	93
4.21	The screen for displaying questions chosen by the lecturers	94

4.22	Confirming message for editing questions	94
4.23	Confirming message for deleting questions	95
4.24	The main screen for report functionality	95
4.25 (a)	The single student report	96
4.25 (b)	The single student report selected	97
4.26	All students report	98
4.27 (a)	The student answer report tab with selected student row	99
4.27 (b)	The student answer report	99
4.28 (a)	The interface for student login	100
4.28 (b)	The user interface for the Student Exam	100
4.29	The student report result	101
4.30	The student answer interface case 1	102
4.31	The similar word	104
4.32	The student report result case 1	105
4.33	The student answer interface case 2	106
4.34	The similar words	107
4.35	The student report result case 2	108

CHAPTER 1

INTRODUCTION

This chapter briefly explains the background of the project that mainly involves the modified BLUE Algorithm with expert system to manage the structure management exam implemented at Bandar Darulaman Community College. The problem statement, objectives, significance of the project and scopes are also presented in this chapter.

1.1 BACKGROUND

Teaching and Learning are the most crucial part in the education process. However, the assessment is one of the most common way to evaluate student performance. Most of the existing education assessments such as objective testing exercises, structured question, practical exam and other. However, in order to fully assess the students' learning progress, these should be complemented with open-ended questions (Whittington & Hunt, 1999). It has been noted that assessment based only in multiple -choice, fill-in-the-blank or yes/no questions is not accurate enough to measure the amount of knowledge the students have acquired, or whether they have understood the subject, Therefore, the field called Computer-Assisted Assessment

The contents of
the thesis is for
internal user
only

- **Integrating Natural Language Processing (NLP) techniques with the system to improve the reliability of the system in managing textual answers.**

REFERENCES

- Abney, S. (1996), Part-of-Speech Tagging and Partial Parsing, in Ken Church, Steve Young, and Gerald F. Bost, eds. *Corpus-Based Methods in Language and Speech*, Kluwer Academic Publishers, Dordrecht.
- Bloom, B. (1956), *Taxonomy of educational objectives: The classification of educational goals. Handbook I. cognitive domain*. New York ; Toronto: Longmans, Green.
- Brill, E., Mooney, R. (1997). The art of Empirical Natural Language Processing, *AI Magazine*, 18(1), 13-24, 1997.
- Burstein, J. and Marcopolo, C. (2000). Toward using text summarization for essay-based feedback. *CHI 2000*, 2000.
- Burstein, J., Finkler, M., Wang, S., Lu, C., Chodorow, M., Bradenharder, L. and Harris, M. D. (2001). Automated scoring using a hybrid feature identification technique. *Proceedings of the Annual Meeting of the Association of Computational Linguistics*.
- Burstein, J., Leacock, G. and Martin, (2001). Automated evaluation of essays and short answers. *Proceedings of the International CAA Conference*.
- Callan, J., Croft, G. and Galletta, D. (1995). Trec and tipster experiments with inquiry. *Information Systems and Management*.
- Carro, R. M., Pulido, J. and Infante, P. (1999). Dynamic generation of adaptive internet-based learning environments. *Journal of Network and Computer Applications*, 22 (4), 249-257.
- Chung, G. and Burstein, J. (2001). Methodological approaches to online scoring of essays. *Proceedings of the Annual Meeting of the National Center for Research on Evaluation, Measurement, and Testing*.
- Conlon, G. (1987). *Assessing the measures of writing ability*, New York: Longman, chapter 4. *Assessing writing: measures and strategies*, pp. 109–125.
- Cowie, J. and Hirst, D. (1990). Information extraction. *In Communications of the ACM* 39(1).
- Cristea, D., Cristea, M., Gheorghiu, C. and I. Pistol. (2005). Summarisation through discourse analysis. *Proceedings of the ICCLING 2005*.

- D. Callear, J. Doolan, G. Smith, & M. Soh. (2001). CAA of short non-MCQ answers. *Proceedings of the 5th International CAA conference*, Loughborough, UK.
- D. Callear, J. Doolan, G. Smith, & M. Soh. (2001). "CAA of short non-MCQ answers". *Proceedings of the 5th International CAA conference*, Loughborough, UK.
- Dagan, I., & Elmasry, M. P. (1985). Committee-based sampling for training probability distributions. *In proceedings of the Twelfth International Conference on Machine Learning*, p. 11. 1985 San Francisco, CA. Morgan Kaufman.
- Delmonte, P. (1997). Learning with an LFG-based lexicon and conceptual representation. *Journal of the American Society for the History of the Humanities*, 24 (5-6), 461-488.
- Delmonte, P. (1998). Determining essential properties of linguistic objects. *In proceedings of the workshop on computational morphology resolution*. In *proceedings of the workshop on computational morphology resolution* (pp. 10-24). Pisa.
- Delmonte, P., & G. Smith, E. (1992). GETA_RUN—A general text analyzer for natural language understanding. *In proceedings of the 3rd conference on applied artificial intelligence processing—Association for Computational Linguistics*, 9-10: ACL.
- Delmonte, P. (1993). Analogues from texts: How to generate answers from a text. *In convegno Nazionale Associazione Italiana di Intelligenza Artificiale (AI*IA)* (p. 139-143). Padova: AI*IA
- Denton, P. (1997). 'electronic feedback' marking assistant and analysis of question types detection facility. *In proceedings of the 7th Computer Assisted Assessment Conference*.
- Dessus, P., & Veronis, A. (2000). Free text assessment in a virtual campus. *In proceedings of the 11th International Conference on Human System Learning*.
- Dessus, P., & Veronis, A. (2000). Free text assessment in a virtual campus. *In proceedings of the 11th International Conference on Human System Learning*.
- Dessus, P., & Veronis, A. (2000). Free text assessment in a virtual campus. *In proceedings of the 11th International Conference on Human System Learning*.
- Diana Pérez & Elmasry (2005). Application of the BLEU Algorithm for Recognizing Machine Translations. *In proceedings of the First PASCAL Recognizing Machine Translations Challenge*.

- Doddington, G. (2002). Automatic Evaluation of Machine Translation Quality Using N-gram and Word-Sequence Statistics. *Paper presented at the Human Language Technology Conference, March 24-27, 2002, San Diego, CA, USA.*
- Foltz, P., Lafferty, J., & Landauer, T. (1999). The intelligent essay assessor: Applications of natural language technology. *Interactive Multimedia Electronic Journal of Research in Intelligent Learning.*
- Foltz, P.W., Lafferty, J., & Landauer, T.K. (1999) Automated Essay Scoring : Applications of Natural Language Technology. *Proceedings of ED-MEDIA '99 Conference, Lake Arrowhead, USA.*
- G. Puscasut, C. G. & A. B. Newow. (2004) Temporal resolution. *In proceedings of the Language and Education Conference (LREC-2004), 2004.*
- Graesser, P., M. G. Leutner, K. G. Flower-Hastings, D. Harter, Tutoring Research Group. (2000) Using latent semantic analysis to evaluate the contribution of students in a tutor. *Interactive Learning Environments, 8(2):123-140.*
- Hearst, M. (2000) Using latent semantic analysis for automated essay grading, In: IEEE Intelligent Systems, 15(4):35-37.
- K. Papineni, S. Roukos, J. Ward, & Wei-Jing Zhu (2001). BLEU: a method for automatic evaluation of machine translation. *In technical Report RC22176 (W0109- 022), IBM Research Division, Thomas J. Watson Research Center (2001).*
- Kanejiya, D. (2003). Automatic Evaluation of Students' Answers using Latent Semantically-Annotated LSA. *Human Language Technology Conference of the Association for Computational Linguistics (ACL 03) Workshop on Building Educational Applications, Toronto, Canada.*
- Kintsch, D., & Greenberg, J. (2000) The LSA Research Group. (2000). Developing summaries of text through the use of lsa-based feedback. *Interactive Learning Environments, 8(2):109-122.*
- Kishore Papineni, S. Roukos, J. Ward, & Wei-Jing Zhu. (2002). BLEU: A Method for Automatic Evaluation of Machine Translation. *In proceedings of the 40th Annual Meeting of the Association for Computational Linguistics.*
- Knowles, J. (2002) Unit 3. Learning and teaching on the web: Computer Assisted Learning.

- Larkey, L. S. (1997). Automatic essay grading using text categorization techniques. *In Proceedings of the 21st Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, pp. 90–95.
- Lewis, D. E., and Elkan, J. C. (1998). Heterogeneous uncertainty sampling for supervised learning. *In Proceedings of the Eleventh International Conference on Machine Learning*, pp. 1–12. San Francisco, CA. Morgan Kaufman.
- Liere, R., and Elkan, J. (1995). Inductive learning with committees for text categorization. *In Proceedings of the Fourteenth National Conference on Artificial Intelligence*, pp. 50–55. Providence, RI.
- Little, J. (2000). The development of essays. Term Paper, Expert Systems.
- M. Glass. (1999). The development of Expert Systems for Tutorial Applications. *In Proceedings of the 1999 AAAI Conference on Artificial Intelligence: CIRCSIM-Tutor Intelligent System. AAAI 2000 Fall Symposium*, pp. 1–12.
- Mason, O., and Aldridge, N. (2002). Automated free text marking with paperless assessment. *In Proceedings of the Sixth International Computer Assisted Assessment Conference*, Loughborough University, Loughborough, UK.
- Mikhailov, G. (2000). Intelligent Engineering Systems Through Artificial Neural Networks.
- Ming, P.Y., and Elkan, J. C., and Elkan, T.L. (2000). Intelligent essay marking systems. *In Proceedings of the AAAI Conference on Artificial Intelligence, Feb. 2000*, Polytechnic, Singapore.
- Ming, Y., and Elkan, J. C. (2000). Intelligent essay marking system. *In Learning and Intelligent Systems*, pp. 1–12.
- Mitchell, T., Elkan, J. C., and Aldridge, N. (2002). Towards Robust Computer Assisted Free Text Responses. *In presented to the CAA Conference*, Loughborough University.
- Nunamaker, J. F. (1991). System Development in Information Management *Information Systems*, 7:3, pp. 89 – 106.
- O. Postolache (2000). A reference model on excerpt from a novel. *In proceedings of the Summer School in Logic Language and Informatics*, Loughborough University, France.
- Palmer, J., and Elkan, J. C. (2000). Automated essay grading system applied to the subject of biology - how can we do it better?, *In Informatics in Education - Where Parallels Intersect*.

- Perez, E. Alfaro (2004), Application of the Bleu method for evaluating machine translation in the e-learning environment. *In proceedings of LREC-2004*, 2004.
- Porter, M. (1980). An algorithm for suffix stripping. *Program* 14(3), 130–137.
- Ros'e, C., Ros'ne, C., & K. (2003). 'A hybrid text classification approach for the 'mys' Build Educational Applications Using Natural Language Processing. *Journal of Educational Technology*, 1(1), 47-75.
- Rudner, L. and G. (2002). Automated essay scoring using bayes' theorem, in 'Proceedings of the 10th Annual Meeting of the National Council on Measurement in Education', 2002.
- Rudner, L. and G. (2002). Automated essay scoring using bayes' theorem. *In proceedings of the 10th Annual Meeting of the National Council on Measurement in Education*, 2002.
- Rudner, L.M. (2003). Automated essay scoring using Bayes' Theorem. *The Journal of Educational Computing and Assessment*, 1(2), 3-21.
- S. Valenti, S. (2003). An overview of current research on automatic essay scoring. *Journal of Information Technology Education*, 2:319–327.
- Sealey, C., J. (2003), At the coal face. experiences of computer assisted assessment. *Proceedings of the 7th Computer Assisted Assessment Conference*, 2003.
- Streeter, L. (2003). The credible grading machine. *Journal of Educational Computing and Assessment*, 1(2), 1-2.
- Sukkarieh, S. (2003). Auto-marking: using computer to grade free text responses. *In paper presented at the 7th International Association for Educational Assessment Conference*, 2003.
- Sukkarieh, S. (2003). Auto-marking: using computer to grade short, free text responses. *In paper presented at the 7th International Association for Educational Assessment Conference*, 2003.
- T. Mitchell, J. (2002). Towards robust computer assisted assessment responses. *In proceedings of the 6th CAA Conference*, 2002.

- Thomas, D., & Petre (2004). E-Assessment using Latent Semantic Analysis in a Computer Science Domain: A Pilot Study. *In Proc. of the eLearning Conference on Computational Linguistics and Computational Linguistics for eLearning* (2004), pp 38- 44, Geneva, 2004 [THD04].
- Valenti, F. M. (2003). An overview of current research on automated assessment. *Journal of Information Technology Education*, 2:319–330.
- Vicedo & F. M. Valenti (2000). The use of pronominal anaphora resolution to question classification. *In Proceedings of the 38th Annual Meeting of the Association for Computational Linguistics (ACL)*, pages 555–562, 2000.
- Whittingdon, J. (1999). Approaches to the Computerised Assessment of Free-Text. *In Proceedings of the International Computer Assisted Assessment Conference*, 1-2 June 1999.
- Wiemer-Hastings, P. & M. J. Heffernan (2005) Initial Results and Mixed Directions. *In Proceedings of the IJCAI/AAAI*.
- Williams, P. (2004). Automatically Grading Essays with Markit©. *In Proceedings of the 2004 Conference*, Rockhampton, Queensland.