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C O N T E N T S

2010: Year of Mathematics in Romania and Centenary of Romanian Mathematical Society. An unique Journal in the world: Mathematical Gazette at 115 anniversary

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Abstract

This paper presents some aspects regarding the development of mathematics education in Romania at the centenary of Romanian Mathematical Society (RMS / SSMR). 2010 was declared "Year of Mathematical Education in Romania" with the slogan "Everything is correct thinking is Mathematics" (Grigore Moisil). In the 115 years of developing, Mathematical Gazette ("Gazeta Matematica" Journal is founded in 1895) contributed and continues to contribute to the training of specialists, conscience and character. Students, teachers of various disciplines, mathematicians, engineers, economists and researchers who do, at school, college or university, Mathematical Gazette problems or issues proposed and articles published in Mathematical Gazette, were animated by a passion for Mathematics for creative thinking, for demonstration and argument. This passion was encouraged by a stimulating and motivating framework of collaboration Mathematical Gazette. From the appearance, in 1895, and until now, the journal was an important landmark and a true Romanian mathematics school and has contributed to the formation of many generations of young fans of mathematics, from which many mathematicians have emerged Why do credit Romania worldwide. Mathematical Gazette is the most famous mathematical journal in Romania for youth to develop and strengthen math education. Mathematical Gazette is an unique Journal in the world.

Keywords: Romanian Mathematical Society, Mathematical Education, Mathematical Gazette, creative thinking

1 Introduction and Motivation

Motto: "*All what is correct thinking is either mathematics or feasible to be transposed in a mathematical model*." Grigore C. Moisil (1906-1973), President of the first International Mathematical Olympiad (1959, Romania);
"*You are never sure whether or not a problem is good unless you actually solve it*."
Mikhail Gromov (Abel Prize, 2009)

Mathematical School in Romania was developed under the influence of European education system. In Iassy, in the year 1795 is printed the first book in Romanian mathematics by *Amfilohie Hotiniul* (Arithmetic elements, translated and adapted after Arithmetic by Italian *Alessandro Conti*). *Amfilohie Hotiniul* was Roman scholar, bishop of Hotin who campaigned to replace the teaching of Greek to Romanian. Of philosophical interest is "*Gramatica de la învățătura fizicii"* (The Grammar of Learning Physics) – 1796, which handled an Italian

encyclopaedia of sciences from the 18th century, which contained not only well known for that time considerations regarding philosophy as the study of matter, but also astronomical, geographic, zoological, chemical and anatomical facts. The activity of *Amfilohie Hotiniul* as popularizer of sciences did not come into opposition with his theological vocation, because he considered the subjects of sciences as *divine creations* (http://www.romanian-philosophy.ro). After concluding the Russo-Turkish war (1828 - 1829), the Peace of Adrianopol (1829) was introduced in the Romanian Principalities an "*Organic Statute*". Public education was organized in four stages: beginner schools, human schools, complementary teachings, and special courses.

Schools for special courses were three sections of which one was for applied mathematics where teaching trigonometry, differential and integral calculation, mechanical, etc. Of these schools later developed Romanian universities. Between 1835 - 1847 worked in Iassy Mihaileana Academy, the first Romanian high school in Moldova, established under the reign of *Mihai Sturdza*. In this contribution had *Gheorghe Asachi*, *Eftimie Murgu* and others. In 1860 Prince Alexandru Ioan Cuza signed the decree the establishment of the University of Iassy and in 1864 by the University of Bucharest.

In 1864 *Prince Alexandru Ioan Cuza* signed the law to introduce compulsory primary education (four years) and secondary (seven years). In 1898 *Spiru Haret* divides education into three cycles of four years: primary, secondary and high scool. In 1881 was founded "*National School of Bridges and Roads*" of Bucharest. In 1920 it becomes the "*Polytechnic School*", now the "Polytechnic" University of Bucharest. At that time began to be noted for enthusiastic personalities of Romanian school mathematics learning progress.

NOTE: Journal of scientific recess – "*The first the furrow* "- http://www. recreatiimatematice.ro, "*Review of Scientific recess is the first scientific journal in the country to address issues of youth in all branches of science, but with a predominantly mathematical content*" is the first time in Iassy, 15 January 1883 until 1888. Resumes his appearance in 1999 all in Iassy. Appears today.

2 About beginnings and initiatives

Motto: "*Thinking, knowledge, life, and the pursuit of happiness - all that matters."*
M. Vlada, 2010

Foundation of Mathematical Gazette Journal

In October 1894, five young engineers *Victor Balaban*, *Vasile Cristescu*, *Ion Ionescu*, *Mihail Roco*, and *Ioan Zottu* (founders believe GM), graduates of the School of Bridges and Roads of Bucharest (now Polytechnic University of Bucharest), have proposed a Romanian journal of mathematics to "*our high school students*". Journal name was chosen "*Mathematical Gazette*" (Gazeta Matematică). The first issue of the Mathematical Gazette came with 16 pages on 15 September 1895, the day after it has been tested and verified with a heavy train, bridge at Cernavoda. This bridge was built under the leadership eng. Anghel Saligny and construction was the largest of its kind in Europe at that time.

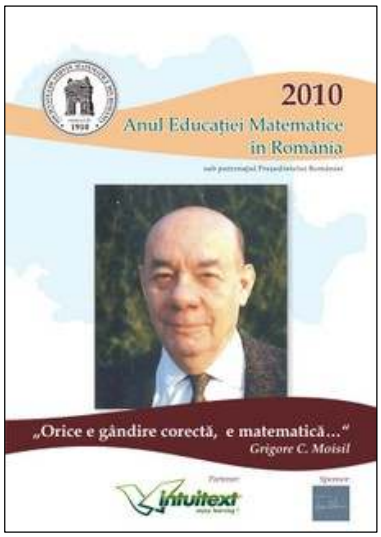
The aims of Gazeta Matematică, as stated in its first issue (September 15, 1895), were:

- to publish original papers in mathematics;
- to develop the appetite for the study of mathematics and for doing original research.

In the 115 years of developing, Mathematical Gazette contributed and continues to contribute to the training of specialists, conscience and character. Students, teachers of various disciplines, mathematicians, engineers, economists and researchers who do, at school, college or university,

Mathematical Gazette problems or issues proposed and articles published in Mathematical Gazette, were animated by a passion for Mathematics for creative thinking, for demonstration and argument. This passion was encouraged by a stimulating and motivating framework of collaboration Mathematical Gazette (Vlada 2010a).

From the appearance, in 1895, and until now, the journal was an important landmark and a true Romanian mathematics school mathematics has contributed to the formation of many generations of young fans of mathematics, from which many mathematicians have emerged Why do credit Romania worldwide. Mathematical Gazette is the most famous mathematical journal in Romania for youth to develop and strengthen math education. Journal said in its first appearance that is a mathematics journal for youth and strengthen math education.



Foundation of Mathematical Gazette Society

In 1909 the editors of the Mathematical Gazette ("Gazeta Matematică") met and decided to set up the Mathematical Gazette Society. The members of the new Society are listed in the first issue of volume 15 of the Mathematical Gazette. The Society became a legal entity in the following year when its statutes were accepted and *King Carol I* promulgated the law establishing the Mathematical Gazette Society by Royal decree No. 3798/1910.

The Society managed to continue to publish the Gazeta Matematica, despite the loss of their headquarters and library, operating from private houses from four years before the Faculty of Mathematics of the University of Bucharest gave them two rooms from which to run the Society.

Romania, initiator of the International Mathematical Olympiad

The annual mathematical contests organised by the Society became National Olympiad competitions in 1949. In 1959, *Professor Tiberiu Roman*, general secretary of SSMF, had the idea of organizing the first International Mathematical Olympiad (IMO) in Brasov. *Grigore C. Moisil* (1906-1973), President of SSMF at the time, organized the first IMO (1959, Romania). "*After that the Fifth Congress of the Romanian Mathematicians organized by the Romanian Society of Mathematical and Physical Sciences, it was proposed that an International Mathematical Olympiad competition be set up. The Society organized the International Mathematical Olympiad competition in Romania in 1959, 1960, 1969, 1978 and 1999* ". (Berinde M. and Berinde V. 2001)

"*What is the IMO*?" The International Mathematical Olympiad (IMO) is the World Championship Mathematics Competition for High School students. The first IMO was held in 1959, hosted by Romania, with seven countries participating: Hungary, Bulgaria, Poland, Czechoslovakia, East Germany and USSR. Since then, the participating countries have taken turns in hosting it. The number of participating countries increased to 97 countries from all continents in the 49th IMO (http://www.imo2009.de).

"*The International Mathematical Olympiad (IMO) is the World Championship Mathematics Competition for High School students and is held annually in a different country. The first IMO was held in 1959 in Romania, with 7 countries participating. It has gradually expanded to over 100 countries from 5 continents*".

Source: http://www.imo-official.org/ and http://www.imo-official.org/organizers.aspx
Note: Bulgaria is initiator of the International Olympiad in Informatics (IOI) (1989, Pravetz) - http://ioinformatics.org/index.shtml.

The 50th International Mathematical Olympiad, 2009, Germany

The 51st International Mathematical Olympiad, 2010, Kazakhstan

"*As a creator and promoter of the IMO, Romania's scientific benefits are significant. If we use the data collected in [3] for the period 1959-2003, more than two thirds of former Romanian IMO contestants are or were involved in academia or research, in Romania or abroad.*" (Berinde V. and Păcurar M. 2009).

We mention here a few names, accompanied by the year when they have first competed in the IMO: V. Barbu (1959), S. Strătilă, C. Năstăsescu and T. Zamfirescu (1960), G. Lusztig and L. Bădescu (1961), L. Zsido (1963), D. Voiculescu and E. Popa (1965), D. Ralescu (1967), Al. Dimca and R. Gologan (1970), D. Timotin (1971), M. Pimsner (1972), A. Ocneanu (1973), M. Coltţoiu and D. Vuza (1974), Al. Zaharescu and V. Nistor (1978), M. Mitrea (1981), L. Funar (1983), P. Mironescu and D. Tătaru (1984), A. Moroianu and A. Vasiu (1987), F. Belgun and T. Bănică (1988), S. Moroianu, M. Crainic and D. Iftimie (1990).

3 Why Mathematics?

Mathematical Gazette fate is composed of "*ups and downs*" as it is with a man's life. Weather difficulties were defeated with the help of fans Mathematical Gazette, and were not few. And young and older should know this, so that lessons went through Mathematical Gazette to extract those that lead to progress, development and knowledge. If Mathematics was not, nothing would be was no wheel and no computer, no pattern and no phone, no Informatics or Cybernetics. But to all these entities materials invented by man, Mathematics helps man to think about life, create and imagine, to love nature and his fellows, to be emotional and brave, to be consistent and orderly to dream and be happy.

Primordial role in promoting mathematics among young people plays a math teacher. It must fulfill its mission of teacher education and teaching methods using the most appropriate mathematical discovery by studying as many students. Teacher should not see in his students "*good students*" and "*weak students*", but "*students*" must be guided to discover the knowledge and skills are encouraged to go through "*step by step*" learning and discovering secrets scientific knowledge (Vlada M. 2010c).

Student being Acad. Professor Miron Nicolescu (1903-1975) recalls that has subscribed to the Mathematical Gazette urging his teacher of mathematics. Here's what he said to this effect: "*My first contact with this magazine was not easy. It seemed to me that I will never understand anything. The ice was broken only when I saw that I can solve a problem proposed by others. Then followed a moment I will never forget: when I saw one of my mathematical notes, printed in the journal. Then came an article, and other items. The road had been traced. From the beginning I knew I could climb higher in mathematical research working hardy*" ("*Academician Professor Miron Nicolescu*" by Marcus Solomon, Mathematical Gazette, no. 11, 1975). In this note Professor Solomon Marcus remembers teacher what told Miron Nicolescu "*Until proven otherwise, any man is good for me and give confidence*".

Today, the mathematics teacher must adapt to new conditions imposed by the new development of Romanian society. It is said by pupils, students and parents that "*Math is hard, that is arid and that is too abstract and theoretical*". Educational Ministry, professional associations, committees of teachers of mathematics and must be based on this analysis and definition of educational reform programs.

Currently, the European Union is operating various research and development programs that are based on scientific knowledge and technological world. For example, in 2009 the European Year of Research and Innovation (*European Year of Creativity and Innovation*), the slogan "*Imagine. Create. Innovate*", has defined the promotion of creative and innovative approaches in different sectors of human activity. It was aimed to promote education in mathematics, scientific and technological skills of basic and advanced conducive to technological innovation, and promote closer links between arts, organizations, schools and universities (http://create2009.europa.eu).

In Romania, in 2009, were held scientific events ICVL (*The 4th International Conference on Vrtual Learning*) and CNIV (*The 7th National Conference on Virtual Learning*). They were held under the auspices of the European Year of Research and Innovation (Vlada 2009).

ICVL and CNIV Projects are scientific events that promote innovative technologies and methodologies in education, research and continuous improvement, both in education environments, namely university and in business. Structured and organized according to European principles and international standards, the two projects encourage and promote work on projects, collaborative activities, methods and scientific experimentation, creative thinking and intuition, reasoning and demonstration.

4 Beginnings - Founders and "pillars" Mathematical Gazette

In October 1894, five young engineers *Victor Balaban*, *Vasile Cristescu*, *Ion Ionescu*, *Mihail Roco* and *Ioan Zottu* (founders believe GM), graduates of the School of Bridges and Roads of Bucharest (now Polytechnic University of Bucharest), have discussed poor results obtained by candidates in entrance examinations that year. In conclusion, he proposed a Romanian journal of

mathematics to "our high school students". Name the Journal "Mathematics Gazette" was proposed by *Victor Balaban*. It will not see his dream come true because seriously ill and died at the age of 25 years. The first editor of the magazine consisted of five young engineers (*Victor Balaban* has been replaced by *Constantza Pompilian* fresh degree in mathematics from Bucharest and Paris), in which engineers have added *Emanoil Davidescu*, *Maurice Kinbaum*, *Nicolae Niculescu*, *Tancred Constantinescu* and mathematician *Andrei G. Ioachimescu* with degree in mathematics from Paris.

The first issue of the journal Mathematical came with 16 pages on 15 September 1895, the day after it has been tested and verified with a heavy train, Cernavodă Bridge (*Podul de la Cernavodă* - built under the leadership eng. Saligny), the largest construction of its kind in Europe at that time. The same year he joined the editorial mathematician *Gheorghe Țițeica* (Editorial remained until his death), graduated in that year of the Faculty of Bucharest. Followed *Davidoglu A.* (1902), C. *Popovici* (1903), *Traian Lalescu* (1905), and *N. Abramescu* (1907).

- Mathematical Gazette motto "*enthusiasm, harmony, unselfish work, continuous sacrifice*" is the work of engineers and mathematicians.
- In 1901 the journal Mathematical Gazette Library collection opens with the publication of "directory arithmetic problems, algebra, geometry and trigonometry", authors are I. Ionescu, A. Ioachimescu, Gheorghe Titeica, V. Cristescu, which will be printed in Honor.
- "*Pillars*" Mathematical Gazette are considered: Ion Ionescu, a professor at Polytechnic School, the famous mathematician Gheorghe Titeica, professor of mechanical engineer Andrei Ioachimescu and Vasile Cristescu (authors collection ITIC).
- In 1909, an editorial board meeting held at Valea Calugareasca, decided the establishment Society Mathematical Gazette (Gazette editorial on September 1, 1909 was converted Mathematical Society).
- In 1910 the Chamber of Deputies voted Mathematical Gazette Law Society recognition and King Carol I promulgate the law on recognition of the Mathematical Gazette Society by Royal Decree no. 3798. The time is early history of Mathematical Sciences Society in Romania (SSMR). This year, in September 2010 SSMR centennial anniversary.

The first year there were 144 subscriptions, and then the annual number of subscriptions has increased constantly. Circulation increased rapidly, reaching more than 50,000 copies in 1974 and around 80 years is published in Mathematical Gazette 120000-140000 copies (Trifu 2005).
The following three journals are published by the RMS (Berinde V. 2010):

1. *Bulletin Mathematique de la Societe des Sciences Mathematiques de Roumanie*, which is a quarterly research journal (4 issues a year). It was founded in 1896 and the current volume is 53 (or 101 – old series) in 2010;
2. *Gazeta Matematică, seria B*, which is a monthly journal (12 issues/volume) devoted to elementary mathematics (primary, secondary and high school students and teachers). It was founded in 1895 and has been published continuously in this format. The current volume is 115 (2010);
3. *Gazeta Matematică, seria A*, which is a quarterly journal (4 issues/volume) devoted to teachers of mathematics. The current volume is 107 (or 28 – new series) in 2010.

5 Evolution of Mathematical Gazette

Readers (problem solvers) few at the beginning - 90 peoples in 1950 - is constantly growing, reaching several thousand in 1974. Each issue of the journal contained several pages of finely written solvers name, ordered alphabetically by locality. Contents Gazette is enriched with new items constantly, from articles, notes math exam issues, bibliographies, on request, Miscellaneous,

problems solved, issues proposed, Box solvers. Are almost all fields of mathematics: arithmetic and number theory, *algebra, geometry* (*synthetic, analytic, differential, descriptive*), *trigonometry, calculus, mathematical logic*, etc.. Since 1980 it introduced a new column "*computer problems*". Also since then appeared in several journal articles and the scale of computer science (informatics) and interest of young people for informatics and computer use. This journal's success and attracted many students, teachers, mathematicians, engineers and researchers. In addition, however, managed to rank Editor solving problems in its annual review and award many students. This represents the recognition and consideration for the work of mathematics teachers in Romania schools (Vlada 210b).

Should highlight the importance Mathematical Gazette editorial on the organization of all activities related to journal: publication of the proposed issues and articles, check the solutions sent to the editor, published the names of problem solvers, publishing data from various problems of mathematics exams or competitions, publishing solutions issues, publishing articles and issues regarding the improvement of teachers in maths, mathematical notes, publishing materials on the activities of members of the Society for Mathematical Sciences, today Society for Mathematical Sciences in Romania (SSMR). The year 1950 is a very difficult year for Mathematical Gazette editorial because the state takes abuse and violence, without a title or any other formality buildings Mathematical Gazette Society, respectively Mathematical Gazette Society House 144 (Calea Griviței 144) and "*House reading Ion N. Ionescu*" from . Str. Răsuri no. 25. This act of culture was destroyed physically "*Library of Mathematical Gazette Society*" (See "History of Mathematical Sciences Society in Romania" Trifu 2005, Vlada 2010b)

- In 1949 the unification of the *Mathematical Gazette Society* and *Romanian Society of Sciences* incurrence of *Mathematical Sciences and Physical Society of Romania*, who inherits property under a new status of the two society. President of the new society was *Acad. Grigore C. Moisil*. Mathematical and Physical Sciences Society of Romania organizes *National Mathematics Olympiad. Mathematical Gazette's* annual contests were a national expansion. With financial support from the state math competitions were held in three stages: local, regional, national.
- In 1964, the detachment, the establishment of Mathematical Sciences Society (SSM).

Mathematics Gazette editorial during 1950-1999 was coordinated by the next chief editors: 1956-1968, Sacter O.; 1969-1974, Ionescu-Țiu Constantin; 1974-1980, Pârşan Liviu; 1980-1995, Teodorescu Nicolae; 1996-1999, Țena Marcel. Management Society of Mathematical Sciences in Romania to establish: 1949-1973, acad. Grigore C. Moisil -president; 1973-1995 acad. Nicolae Teodorescu - president; since 1995 acad. Petre Mocanu – president; since 2004 prof. dr. Dorin Popescu – president; since 2007 prof. dr. Radu Gologan – president.

After 1989, the Mathematical Gazette editorial occurred several changes. The circulation began to decline. In 1995, in the 110 th year of its appearance, Series B, Mathematical Gazette was printed in 8000 copies and Series A in 700 copies. Magazine appearance was possible by attracting sponsors. Today, the journal and the promotion of mathematics is supported by the company Softwin. They use several ways of communication and information processing for all activities related to the magazine. All these forms attempt to cope with various negative aspects appeared in the interest of young people towards mathematics, and generally to teaching and education.

In fact, if you make a more thorough analysis can be inferred that there is probably the same negative conditions caused by the five young founders of the Mathematical Gazette in 1895, to consider an initiative on the youth culture of high school mathematics in Romanian. Today, there are obvious many more ways of initiative, but it should be noted that some young enthusiasm and

will could not be planned and may not be searched or checked. In conclusion, solutions are found throughout the events, attitudes and initiatives of our young people and others-colleagues, friends, organizations, governors have an obligation to support them and encourage them. Nowadays, the use of IT technologies and Web is different ways of attracting young people in problem solving activity: http://www.olimpiade.ro/, http://www.viitoriolimpici.ro/, http://www.concurs-euclid.ro/, http://www.cangurul.ro/, http://www.arhimede.ro/, http://www.experior.ro/ .

6 TOP 100: Creative work at the Mathematical Gazette (1895-2005)

Creative work at Mathematical Gazette: Problems and articles published in GM (period 1895-2005) by students, teachers, mathematicians, engineers and researchers (Vlada 2010a).
NOTE: Information on the number of proposed problems and articles published in GM during 1895-2005 are taken from the electronic edition of the Mathematical Gazette SSMR and company Softwin. Application offered "*The authors list*". Data were taken manually and automatically processed by sorting "Total" of proposed problems and articles (SSMR 2005).

No	First and Last Name	Problems	Article	Total
1	Ionescu-Ţiu Constantin D.	2289	16	2305
2	Ionescu Ion	635	421	1056
3	Bătineţu-Giurgiu Dumitru	681	62	743
4	Buicliu Gh.	462	191	653
5	Chiriţă Marcel	349	169	518
6	Panaitopol Laurenţiu	479	18	497
7	Pârşan Liviu C.	460	15	475
8	Linteş Ioan Gheorghe	274	140	414
9	Szőllőssy Gheorghe	368	3	371
10	Simionescu Gh. D.	279	42	321
11	Doboşan Aurel	284	1	285
12	Safta Ion	263	1	264
13	Ţena Marcel	230	31	261
14	Ghermănescu M.	206	51	257
15	Tomescu Ioan I.	230	24	254
16	Ţiţeica Gabriela	145	108	253
17	Thebault V.	131	112	243
18	Teodorescu Nicolae	95	146	241
19	Rotaru Florin	238	0	238
20	Bencze Mihaly	172	62	234
21	Ioachimescu Dumitru	187	40	227
22	Abramecu N.	166	57	223
23	Atanasiu Ionel	199	0	199
24	Mihăileanu Nicolae N.	148	46	194
25	Pavelescu Nicolae	179	14	193
26	Constantinescu Laura	187	1	188
27	Teodorescu Ioan St.	153	28	181

28	Nicula Virgil	153	13	166
29	Andronache Marian	160	5	165
30	Cristescu V.	105	59	164
31	Motrici Cristinel	150	7	157
32	Andreescu Titu	146	11	157
33	Sergescu Petre C.	74	83	157
34	Ionescu-Bujor Constantin Th.	94	62	156
35	Maftei Ioan	148	4	152
36	Apostol Constantin	150	1	151
37	Pop Valer	147	0	147
38	Ghiță Romiță	146	1	147
39	Ghiță Ioan	142	1	143
40	Acu Florin Dumitru	127	16	143
41	Ghioca Adrian P.	134	7	141
42	Stoenescu Alexandru	90	49	139
43	Lalescu Traian	82	56	138
44	Achim Gh.	137	0	137
45	Angheluță Th.	100	37	137
46	Ene Aurel	136	0	136
47	Tudor Ionel	135	1	136
48	Lascu Mircea Mihai	127	8	135
49	Miheț Dorel	129	4	133
50	Țino Ovidiu	97	36	133
51	Predescu Ioan Z.	130	0	130
52	Firu Doru	128	0	128
53	Focșăneanu Mihail I.	76	50	126
54	Gheorghiu Șerban A.	92	33	125
55	Anca Dorinel	119	4	123
56	Costachescu Cezar	117	5	122
57	Radu Dan	120	1	121
58	Cojocaru Daniel	118	0	118
59	Ursărescu Marian	117	1	118
60	Ghergu Marius	111	6	117
61	Săvulescu D.	114	1	115
62	Alexe Ștefan	110	4	114
63	Coșniță Cezar	103	9	112
64	Florescu Ioan B.	67	45	112
65	Miculiță Mihai	105	6	111
66	Vulpescu-Jalea Florin	101	10	111
67	Becheanu Mircea	89	21	110
68	Smarandache Ștefan	108	0	108
69	Șerbănescu Dinu	103	5	108
70	Vlada Marin	99	5	104
71	Brânzei Dan	90	14	104
72	Grecu Cristian	102	0	102
73	Caragea Constantin	99	3	102
74	Pop Ovidiu	99	3	102
75	Ilie Romeo	100	0	100

76	Ţifui Stefan	99	0	99
77	Zidaru Vasile	99	0	99
78	Barisien E.N.	93	6	99
79	Sacter Octav	82	16	98
80	Popoviciu Tiberiu	64	34	98
81	Georgescu Corneliu	90	7	97
82	Andrica Dorin	83	12	95
83	Zapan Grigore C.	76	19	95
84	Gheorghiu Gheorghe Th.	67	28	95
85	Vicol-Turcanu Gheorghe	93	0	93
86	Iacob Eugeniu St.	79	14	93
87	Marnescu Damian	92	0	92
88	Bostan Gh.	90	2	92
89	Sireţchi Gheorghe	84	8	92
90	Roşu Alexandru	66	26	92
91	Cocea Th. Gheorghe	84	7	91
92	Secleman Dan	89	0	89
93	Molea Gheorghe F.	88	1	89
94	Niculescu Liliana	87	2	89
95	Abasohn Ernest	77	12	89
96	Nicolau Constantin H.	79	9	88
97	Ottescu Constantin	79	9	88
98	Zapan Gheorghe	67	20	87
99	Adam Mircea	65	22	87
100	Bebea Nicolae	85	0	85
101	Voicu Ioan	83	2	85
102	Matrosenco Valentin	84	0	84
103	Savu Ion	79	5	84
104	Ştefănescu Emil	74	10	84
105	Nedelcu Ion	83	0	83
106	Piticari Miahai	77	6	83
107	Rădulescu Sorin	80	0	80
108	Panaitopol Maria	76	4	80
109	Eckstein Alfred	80	0	80
110	Musta Ştefan	72	7	79

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Development of Foreign Language Learning System Focusing on Speaking and Evaluation of the Effectiveness

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Abstract

This is a report on a learning system aimed at improving foreign language speaking skills through memorization of short sentences. The method of the system is as follows:
1. A short sentence in the learner's mother tongue is either displayed on a computer monitor, or is communicated by audio. 2. The learner translates the sentence quickly. 3. The system displays the correct answer. 4. The system then selects and displays another short sentence from the collection.
The above steps are repeated. The learner is to memorize all translations.
We evaluated the learning effectiveness of the system for improving speaking skills by asking few participants to use the system. We created short sentences and equally divided them into Set A and Set B. Set A contained sentences that are be learned, and Set B contained sentences that are not to be learned. The participants were subjected to pre-test and post-tests containing sentences from both sets. The participants' vocal answers for both pre and post tests were evaluated in terms of fluency. The evaluation revealed that not only did the participants improve their speaking skills for the sentences in Set A (direct effect), they showed improvements toward sentences in Set B (indirect effect). More specifically, indirect effects were observed for 7 out of 9 sentences as a statistical significance.

Keywords: E-learning, Language education, Evaluation, Speaking skill

Introduction

This paper deals with a learning system designed to improve speaking skills of the students in a foreign language. In this learning system, the goal of the students is to memorize all English translation of short Japanese sentences in accordance with the method described below.

First, a computer selects a short sentence from a collection of sentences in a particular theme and the presents it to the student (either visually on a monitor or through audio). The computer then encourages the student to answer in English. The computer will then display the correct answer (either on monitor or using audio) upon request from the student. The student then tries to memorize the correct answer. Through these basic autonomous steps, the system aims to help the student achieve fluent command of foreign language expressions.

This paper discusses the design principles behind the randomized selection of the short sentences used in the system as well as the learning effectiveness through memorizing the sentences using the learning system.

There are many perspectives on language speaking skills. Some argue that there is a direct correlation between memorization of short English sentences (Kitagawa, 2003), and others argue that speaking skills ought to include an ability to interact with others on top of pure linguistic

skills(Nakamura, 1993). This research is closer to Kitagawa's (1993) since we see memorization of short English sentences as a method of improving one's speaking skills. It is also similar to the perspective of Pawley et al.(1983) that states that memorizing numerous clauses and phrases will lead to fluency.

Principles of the System Design and the Learning Contents

In this research, we have randomly selected the sentences to be memorized. We had decided to utilize computers to make random selection easy. Here, we will discuss the reasoning behind adopting randomly selected sentences.

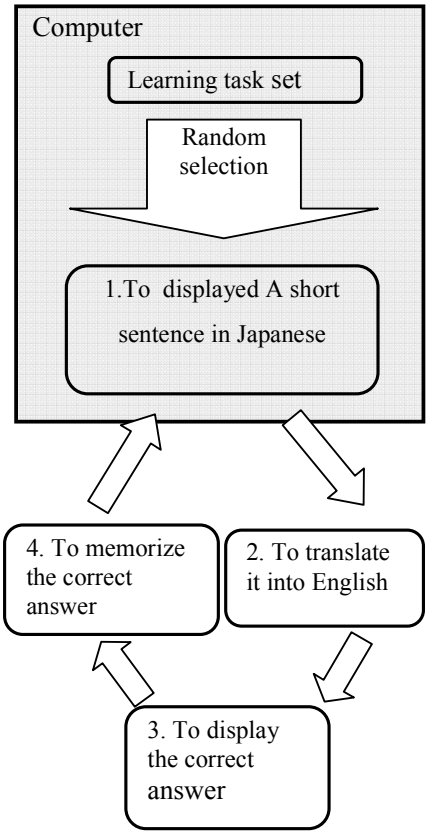

Figure 1. Learning flow

Figure 2. Display screen

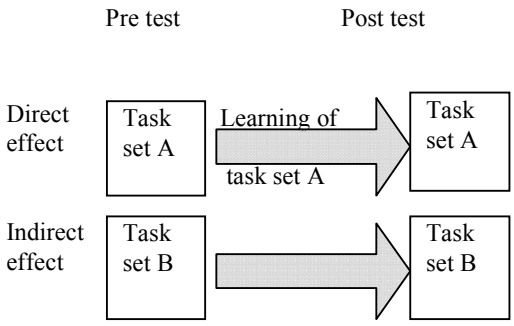

Figure 3. Direct/indirect effect of learning

The first reason is that we considered the students` motivation to learn. In a normal printed learning material, the sequence of example sentences is fixed. However, randomization of the sequence of the subject sentences heightens the students' sense of anticipation, which hopefully leads to higher learning motivation. It is said that heightening spontaneous motivation is important

to language studies. Randomization of the sequence of sentences can potentially heighten the spontaneous motivation of the students (Deci, 2002; Little, 1995).

The second reason is the fact that sequence of conversation is rarely fixed in real life interactions. A real life situation always has incidental and unpredictable occurrences. This corresponds to randomization of the sentences. In a conversation, one often talks about things that they just happen to remember. Also, it is expected that speakers answer unexpected questions without being thrown into confusion. Therefore, a learning style that creates incidental situations and forces students to deal with those situations is logical.

The third reason is that the students have an option to let the computer system sequence the available learning subjects semi-randomly. Students can register their attribute values according to their attributes like their sex and age prior to starting the learning process. Also, each learning subject ischaracterized based on such attributes, and the system developers can set attribute values to each learning subject according to their contents. Computer then compares attribute values of the student to that of the learning subjects to set the probability of displaying a sentence from a particular learning subject. Using this method, a student increases the selection probability of a learning subject that are more relevant to the students. In addition to the above described time-independent attributes, the learning system also has time-dependent attributes. Using time-dependent attributes, the system adjusts probability of selecting a certain sentence from a certain learning subject according to the season the students access the system, or the time of the day the students use the system. In other words, the system can select learning subjects by considering each student's attributes (randomized selection was used in the experiment with human subjects described later).

Based on the above discussed principles, we opted to randomly select the sentences as shown in Fig. 1. As an example of the display, Fig. 2 shows the display when the answer is shown (step 3 of Fig. 1). The area in the middle displays the sentences and answers. Hints also get displayed in the same area. The left hand side of the display is the command area, where *listen to the answer* and *read the answer* buttons are located. On the bottom of the screen is the area where users can type texts. Fig. 2 shows the display after clicking on the *read the answer* button to display the English translation of the Japanese sentence shown.

The Japanese short sentences were written based on the central theme of an international conference. Approximately 100 conversational sentences were written based on experience of the authors. The sentences were divided into 5 levels, from level 1 to level 5. The level designations were done based on sentence length and complexity of the sentence structure. Most of the sentences are accompanied by explanations of the situations. English translation and narrations in Japanese and English were done by professional translators and narrators. From the 5 levels, we used levels 1, 2, and 3 in this research. Examples of the learning sentences are shown below. Situations are described in parenthesis.

Level 1:□When I was asked at the get-together party held by the scientific society, which university am I working for?□Last year I resigned from my university.

Level 2:□One scene of presentation of a paper.□We repeated the experiment many times, but the major results are shown in this chart.

Level 3:□I made a humorous comment as the moderator.□We are already in the 3rd evening of the conference, and everybody must have become tired. If you feel tired, I do not mind that you may fall asleep, but I'd like to have your cooperation in not having any snoring.

Experiment Design and Analysis

For this experiment, evaluation standards for such things like fluency was set based on evaluation standard for English speaking skills utilized by Baba et al.(2003) . We will discuss the experiment design for measuring learning effectiveness and data analysis.

Preparation of Experiment and Method of Learning

[Preparation of the Sentences] Fig. 3 shows the framework of the experiment. Group A, which are to be memorized, and Group B, which are not to be memorized, were both utilized for pre and post tests. The sentences in levels 1, 2, and 3 as discussed previously were divided into Group A and Group B. The central theme used for the group is an international conference as mentioned before. Also, because it was predicted that memorization of the sentences would be extremely difficult, the number of sentences were limited to 13 sentences for both Group A and Group B. The displaying of sentences for pre and post tests was done within the learning system.

The increased score in post test compared to that of pre test can be attributed to the effectiveness of randomization using the system to improve fluency. Hereafter, we will refer to the increase in score on Group A as the direct effect, and the increase in score on Group B as the indirect effect.

[Participants] Five university students (referred to as a, b, c, d, and e)

They all claim to be highly motivated, but have difficulties with speaking English. Their TOEIC scores range from 500 to 600.

[Experiment] The experiment was conducted in the sequence described below.

1. As a pre test, they were shown Japanese sentences from Group A and Group B that were classified as level 2, and then they were asked to recite them in English. Twenty six sentences from Group A and Group B were shown to the participants alternately from each group.

2. Whether sentences from level 2 were at an appropriate level for memorizing for a particular participant was decided during the test (or after the test completion) with discussions with the participants. If the participants decided that the level 2 sentences were too difficult for them, level 1 sentences were given to the participants as pre test. All verbal answers were recorded.

Table 1. *Evaluation of English speaking*
A: learning task set for direct effect measuremnet
B: learning task set for indirect effect measurement
***:p<0.001, **:p<0.01, *:p<0.05 (one side test)

$$\frac{Ys_p - s_qY}{\sqrt{\frac{s_p}{\sigma_p^2} + \frac{s_q}{\sigma_q^2}}},$$

s_p: average score of pre test
s_q: average score of post test
σ_p^2: distribution of pre score
σ_q^2: distsribution of post test score

(a) case	(b)evaluation object (day of the administration)	(c) task set	(d)s_p	(e)s_q	(f)Z-value
1	Subject a, task level 2,□studied 2 days in a row□	A	1.23	3.38	-9.14***
		B	1.31	2.08	-2.25*
2	Subject a, task level 3,□studied 4 days in a row□	A	1.23	4.00	-14.33***
		B	1.23	2.15	-3.21***
3	Subject b, task level 3,□studied 2 days in a row□	A	1.92	4.08	-8.14***
		B	1.85	2.31	-1.48

4	Subject b, task level 3 (6 days. However, studied for 4 days straight, took 1-day break, and then studied 2 days in a row again)	A	1.39	4.08	-10.7***
		B	1.54	2.00	-1.89*
5	Subject c, task level 1,□studied 2 days in a row□	A	2.31	4.69	-10.04***
		B	2.15	2.92	-2.62**
6	Subject c, task level 2,□studied 4 days in a row□	A	2.54	4.69	-8.85***
		B	2.54	3.00	-1.65*
		B'	1.88	2.54	-2.00*
7	Subject d, task level 2,□studied 2 days in a row□	A	2.23	4.77	-12.8***
		B	2.39	3.08	-1.92*
8	Subject e, task level 2,□studied 2 days in a row□	A	2.15	4.77	-9.09***
		B	2.00	2.39	-1.21

3. The Group A for the level determined in step 2 were given to the participants to memorize. It was told to the participants that the goal is for them to be shown Japanese sentences and be able to recite them in English. The students were also instructed to dedicate 30 to 60 minutes to studying daily, but they were to decide how, in the time, they would study. It was explained to the participants that the learning system consists of Japanese audio function, English audio function, and typing input function in the text input field. The participants were given freedom to use specific aspects of the learning system.

As a reference material to determine whether to discontinue the learning, the participants were asked to self-evaluate the degree of memorization for each subject sentence from 1 to 5, and record this self-evaluation on a given sheet.

4. The participants were asked to study the level mentioned in step 3 for a few days. After few days of studying, we determined whether the participants should continue to study the next day based on their self-evaluation of their learning progress.

5. If it was determined that a participant should discontinue studying in step 4, post test was administered right away. The contents of the post test was same as the pre test. Because the learning display would show both sentences that the participants studied and the sentences that they didn't study, the participants were told that they can verbally answer sentences that they have memorized, or sentences that are easy for them to say. All verbal answers given by the participants were recorded.

6. After completing the post test, some participants were asked to go through tasks 1 through 5 for sentences that are one level higher.

[Recording & Learning Environment] Since the material to be learned are related to speaking, the participants were asked to study in a private room to aid their concentration. Equipments used for playing the learning subject sentences and recording are described below.

Play back: Epson Endeavor NA101(Windows XP), SOTEC Multi Media Speaker System Model JSS31-G1

Recording: SONY F-U420(Microphone), Marantz MODEL PMD671 (Digital□□□recorder□

Organization of Verbal Answers

Three participants a, b, and c studied 2 levels.

Participant a and b studied levels 2 and 3, and participant c studied levels 1 and 2. The cases 1 through 6 in Table 1 corresponds to these results. Participants d and e studied level 2 only. These results are shown as cases 7 and 8 in the same table.

Column (b) in the table shows the number of days that the participants required to complete for each case.

Case 6 in Table 1 shows B' in the Subject Group column. This is a group of sentences related to indirect effect. The number of sentences are recorded as 26 for the below described reasons.

Participant c took pre test for level 2 prior to studying level 2 material. However, it was determined that level 2 is too advanced for the participant. Hence level 1 was chosen as the learning subject for the participant. The participant then took pre test for level 1, memorized level 1 material, and then took level 1 post test. After that, the participant took pre test for level 2 once again prior to advancing to level 2 material. Therefore, the participant took level 2 pre test (26 sentences) prior to studying level 1, as well as after studying level 1 material. As a result, these 26 sentences would have had an indirect effect on level 1 measurement.

Evaluation and Analysis

Improvement in fluency was evaluated quantitatively using the verbal answers as described in the previous section. The evaluator was an American engineering postgraduate student. Evaluation standard as described below were shown to the evaluator, and the evaluator was asked to follow the standard. The evaluator was asked to evaluate fluency of the participants as non-native English speakers between the scores of 1 and 5. The evaluation results are shown in Table 1, (d) through (f). Z-score is a statistical value that is used to test differences in means. The test result is shown in the right most column in the table.

The table shows significant direct effect for all cases. Also, there are significant indirect effect in 6 cases, namely cases 1, 2, 4, 5, 6, and 7 of Group B.

The experiment showed significant improvement in fluency by memorizing English translation of specific Japanese sentences using the learning system presented in this study (direct effect). Not only that, improvement in fluency was detected for those sentences that were not in the group for memorization (indirect effect). This result suggests that memorizing English translation of specific sentences help facilitate improvement in speaking skills in much broader sense. The breadth of such effect should be researched through further studies.

Additional evaluation was made from a perspective of sense of similarity of contents in addition to fluency through verbal responses. The sense of similarity of contents referred to here represents if the answers given by the test participants contain the same information in the correct answers in a just-proportion. The similarity referred to here does not concern grammatical structure or vocabulary. However, only 2 cases out of 8 cases shown in Table 1 showed significant improvement (1 case each was determined significant with $p<0.001$ and $p<0.05$).

Discussions

In this research, we were able to obtain results of using the learning system that supports memorizing English sentences for purpose of improving English speaking skills.

Let us discuss the differences and similarities between this learning method relative to other learning methods.

One of the characteristics of this system is memorization of short English sentences. Necessity of memorizing vocabulary and phrases for language learning have been show experimentally. With that, several learning systems based on memorizing individual words have been developed(Ma, 2006; Nakamura, 1993). However, it is difficult to find past research examples for studying memorizing sentences. There is a case of using the memorization technique from the civil service examination in imperial China to memorize relatively long sentences(Kitagawa, 2003). The paper discusses very interesting memorization method through personal experiences, but the paper does not study the method empirically. On the contrary, some computer systems support practicing speaking through responsive reaction(Yoshida et.al., 2008).

From above, we can say that current method for practicing speaking a foreign language either emphasize memorization[10][12] or reaction [13]. This research would be grouped with the former.

Another characteristic of this system is the randomization of sequence of learning subject sentences. Section 2 discussed that one reason for adopting randomization is for student's motivation to learn. The section also discussed that computer was used to make randomization easier. Future research should compare learning systems that use computers with systems based only printed material.

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A Use Case Analysis for Learning in 3D MUVE: A Model Based on Key e-Learning Activities

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Abstract

Virtual learning has already become a mainstream educational methodology, making academic institutions to use a variety of virtual learning techniques with different scales to fulfil their requirements. E-Learning is the major form of virtual learning methodology, which has been widely used to improve the learning processes, ranging from primary education to university and research based education. However, there have been strong criticisms on the e-Learning competence to cater for societal and human needs within the context of learning, backed with behavioural, cultural, and pedagogical constraints. 3D Multi User Virtual Environments (MUVE) show a promising future as better platforms for diverse virtual learning activities, in which some of those would not have been possible with existing methods, including e-Learning. Despite being used as dynamic and engaging environments for learning, 3D MUVE are also capable of complementing blended learning methods with collaboration. However, the present use cases of learning in 3D MUVE are not well defined, and educationalists tend to practice and expect the exact e-Learning use cases in 3D MUVE, creating inconsistencies and loosing the significance of 3D MUVE for learning. This paper proposes a novel approach to consider effective 3D MUVE learning use cases. The use case analysis has been done on a blended perspective of virtual learning. Moreover, the paper critically argues about ineffective learning activities in 3D MUVE that are better off with e-Learning. Security management models for learning in 3D MUVE will be developed based on this use case analysis as the future work of this research.

Keywords: e-Learning issues, learning in 3D virtual worlds, learning use cases, Second Life, Open Simulator, learning environment integration

Introduction

3D virtual worlds are getting into various segments of our society day by day. Virtual worlds with simultaneous interactions of thousands of people in a shared 3D space, show frontier and critical implications for business, education, social and technological sciences, and society at large (Messinger *et al*., 2009). The world's leading universities have been researching on how to use this novel technological medium for their learning processes. They provide more intuitive activities for learning complex and advanced concepts. In fact, virtual worlds are likely to become a mainstream feature of UK education (Kirriemuir, 2008). They are particularly appropriate for educational use due to their alignment with the Kolb's (Kolb *et al*., 2001) concept of experiential learning, and learning through experimentation as a particular form of exploration (Allison *et al*., 2008). Dalgarno (*et al*. 2009) described how researchers have argued that interactive 3D virtual environments demonstrate a great educational potential due to their ability to engage learners in the exploration, construction and manipulation of virtual objects, structures and metaphorical representations of ideas.

Accordingly, many higher education courses when looking for novel and engaging approaches to conduct their practical coursework are interested in the potential of virtual worlds in academia. With the interest for extensive use of 3D MUVE for learning, we believe that the understanding of appropriate learning use cases is essential for its success. As a result, in this research we have focused on identifying key use cases for learning with 3D MUVE supported learning environments. For our research and learning activities, we choose Second Life (Linden Labs, 2003) and Open Simulator (2007) MUVE; more details about the work we have done with these environments will be discussed later. Furthermore, as an e-Learning solution, we consider Moodle (Moodle, 2004) for this research.

This paper is arranged into the following sections: in section 2 we describe background details along with our experiences on learning in 3D MUVE; section 3 explains the high level model we use to analyse 3D MUVE supported learning in the context of existing learning methods. Section 4 elaborates appropriate learning use cases for 3D MUVE learning while considering the research environments we have used as preliminary studies. Section 5 describes the relevance of findings for security policy development as the future research work, before concluding.

Background and Related Work

Despite the advantages of using e-learning, which anyone would agree without a doubt, there have been criticisms on using e-learning as a mainstream method of education. In fact, this was highly examined and commented by Graf and Kinshuk (2009), through their work on e-Learning adaption to standard learning styles. Teo and Gay (2006) have mentioned that trying to map traditional models of learning into e-learning has resulted in few weaknesses that we experience with today's e-learning solutions. Importantly, monotonous ways of interacting students, without their preferred personalization has resulted to poor engagement to learning activities. McGill and Klobas (2009) have studied on e-Learning impact for successful learning activities using an approach of task-technology fit. They have found the perceived benefits of e-learning utilization are higher than that of the actual outcome in the form of student grades. They argue that the technical constraints and underutilization of the possible use cases could have resulted in such observation, through poor collaboration and irrational learning methods, due to overwhelming technology perception of the users. Moreover, technological limitations to provide learning content and activities in rich formats with 3D support can play a significant role for a failure of a learning activity.

Weippl (2005) has also considered an extensive set of factors and use cases for e-Learning security management, which has been used for this analysis in a blended approach. Rich collaboration and user friendliness are expected norms on multiple platforms in blended learning (Brenton, 2009). Blended learning refers to instructional approaches with multiple learning delivery methods, including most often face-to-face classroom with asynchronous and/or synchronous online learning. It is characterized as maximizing the best advantages of face-to-face and online education (Wu *et al.*, 2010). This indicates the possibility of incorporating 3D MUVE as a complementary learning platform with existing learning environments, as we have shown in this paper. However, the new blended learning paradigm should only consist of key learning use cases of 3D MUVE to avoid redundancies and suboptimal practices.

Previous Work

Various educational projects at the University of St Andrews have used virtual environments in their course delivery. These include LAVA (Getchell *et al.*, 2007) and WiFiSL (Sturgeon *et al.*, 2009). MMS, the Module Management System, is an online learning management system which interoperates with Second Life in order to maintain an association of institutional and virtual world

identities as one of its many features. The Laconia Acropolis Virtual Archaeology (LAVA) project allows students to engage with a simulated archaeological excavation, and then explore a recreation of the site in Second Life. The WiFi Virtual Laboratory in Second Life project (WiFiSL) aids teaching and learning about wireless networking by using virtual world interfaces to collaboratively explore and visualise simulations of wireless traffic. Further, we have successfully used Second Life (Perera *et al.*, 2009) and OpenSim for teaching Human Computer Interaction (HCI). Recently, Second Life network traffic has been examined as a validating study of previous researchers' findings and to offer new insights of traffic management. It was performed as a client side measurement, considering Second Life users' actual experiences (Oliver *et al.*, 2010).

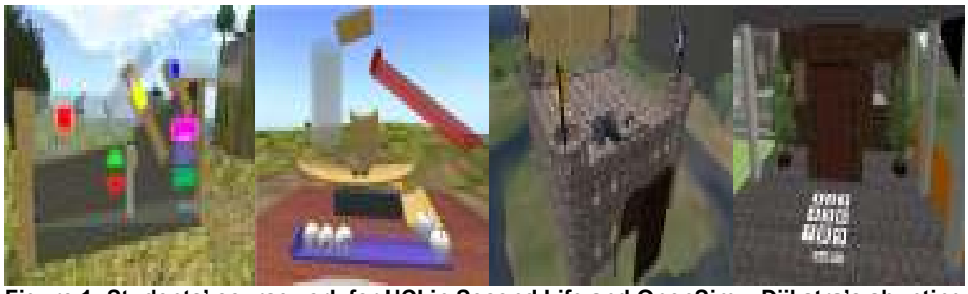

Figure 1: Students' coursework for HCI in Second Life and OpenSim – Dijkstra's shunting yard algorithm simulations, and interactive door systems for enclosures.

The university is in the process of introducing Moodle for its course management in replace of WebCT. Once the transition is completed, the Single-Sign-On based Moodle-MMS e-learning platform will provide a seamless course management service for teaching. With the experience on using 3D MUVE for teaching, we suggest that incorporating 3D MUVE along with existing blended learning environments would generate better outcomes for students and teachers.

Learning with 3D MUVE – Strategic View

The following abstract model indicates learning environment approaches and possible technology applications with a high level perspective. The model is used to analyse how 3D MUVE fit into the existing learning environments, and to evaluate feasible solution stacks to form a productive learning environment. This model analysis will be considered for the use case analysis, later in this paper.

Figure 1: High level model to analyze 3D MUVE integration with learning practices

The model uniquely identifies three core areas of learning methods: traditional learning methods, e-Learning methods and 3D MUVE learning activities. According to the model, for a productive blended learning experience, 3D MUVE should be introduced in a complementary nature to the existing e-Learning and traditional learning system suites. Let us briefly discuss typical characteristics and issues on each of the different combinations that teachers can practice along with selected system environments. Moreover, for this analysis, we presume the individual methods, i.e. traditional learning or e-learning or 3D MUVE learning alone, would only provide suboptimal learning experience; hence trivial to understand and shall not elaborate the issues associated with each case.

Most of the present virtual learning supported educational activities can be seen as complementary approaches of e-Learning and traditional learning combinations. Unless for a pure e-Learning based distance learning activity, all the other learning practices have traditional learning methods such as classroom teaching, in person interactions, practical and laboratory projects, assessment and feedback. Even though e-Learning methods provide learning process optimization through automation and usable content reusing approaches, it cannot entirely replace traditional learning activities that require user collaboration and physical engagement. On the other hand, beyond video content support, e-Learning does not provide simulation facilities to streamline 3D aspects to the virtual learning experience. A learning environment with MOOLDE support can be considered as an example scenario for this category.

No doubt traditional learning is benefited by using 3D MUVE as a supportive tool for 3D simulations and user engagement. Specially, when it comes to explaining complex concepts such as computing algorithms, natural and physical science phenomena, and 3D modelling, 3D MUVE provide unequal features for traditional learning. Moreover, 3D MUVE can be used as an alternative simulation tool to train students virtually, before their actual laboratory experiments. In some instances, this can be the only possible option due to various constraints on real experiments. However, we do not see a comprehensive integration with the learning processes, as 3D MUVE are used as supportive tools. Second Life or Open Simulator virtual region based learning support can be considered as example scenarios for this.

Thirdly, the combination between 3D MUVE and e-Learning also show better results, but it misses the important aspects of traditional learning such as classroom participation, examination and physical engagement. The data consistency and content integration between the two environments have made this option the most effective out of the three, yet it is not the optimal scenario. SLOODLE (2007) integration between Moodle and Second Life/OpenSim is the best example for this type. However, we will further discuss certain inappropriate use cases designed in SLOODLE, which could have been practiced productively with e-Learning systems than in 3D MUVE.

Therefore, it is understandable that for a successful learning experience, there should be complementary facilitation of these three learning environments; we further analyse effective use cases for 3D MUVE learning with that stand, in the next section.

Use Case Analysis for 3D MUVE Learning

Comprehensive use case analyses on virtual learning have not been performed in a larger scale, so far. The main reason for that may be the intrinsic properties of virtual learning use cases that directly map with the pedagogical and traditional learning processes, which have resulted in researchers to consider those as they are. However, this lack of analytical understanding on appropriate use cases for a given learning environment creates difficulties for integrating 3D MUVE with existing learning environments. Furthermore, it results in educators to expect inefficient activities from 3D MUVE, and often makes them to practice such use cases in a meaningless manner.

The following table 1 summarises the default user roles in the Moodle e-Learning environment while indicating the appropriate corresponding roles from Second Life and OpenSim 3D MUVE. It shows the abstract user role definition in 3D MUVE, compared to Moodle or similar e-Learning systems, results in poor granularity on defining learning use cases in 3D MUVE. Learning activity management for complex use cases with distinct roles can be a challenging task to achieve in 3D MUVE. Furthermore, access control and permission models in 3D MUVE are designed for 3D content and land access (Perera *et al.*, 2010), which may not be possible to map directly with e-Learning system access control models. This creates further discrepancies when users expect exact e-learning use case behaviours in 3D MUVE.

Table 1: The comparison of default user roles in Moodle with 3D MUVE

Moodle Role	**Description**	**Second Life**	**OpenSim**
Administrator	system administration (all courses)	Linden Labs	System Owner
Course creator	create courses, teach in them	Land owner / Resident user	Land owner / Resident user
Teacher	teach in and modify assigned courses	Land owner / Resident user	Land owner / Resident user
Non-editing teacher	teach in assigned courses	Resident user	Resident user
Student	resource access and course participation	Resident user	Resident user
Guest	observation only	Visitors	Visitors

Although we can consider all major user roles in the table 1, due to the limited space, let us consider only the student role for the use case analysis, here. In fact, for 3D MUVE, beyond administration tasks of the system and the virtual environment, most of the other use cases are common to different roles; hence the common user role would be 'Resident User' in the virtual region. Therefore, default student role is taken as a resident user, and considered common use cases available for a resident user in default, which are compared in the figure 3 with the Moodle student role.

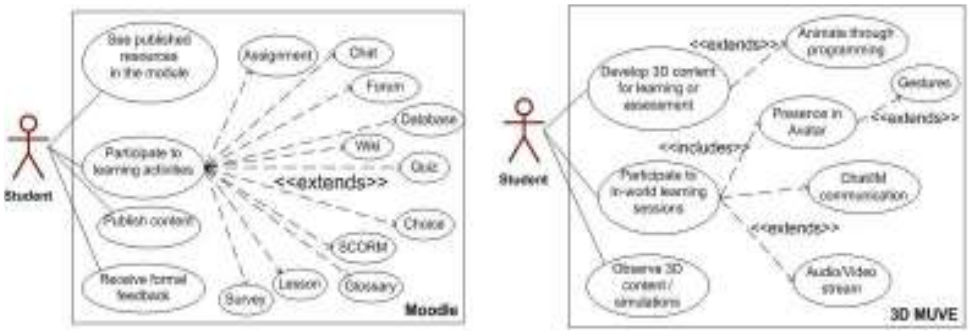

Figure 3: The comparison of learning use cases for the student role in Moodle (version 1.9.9) and generic 3D MUVE. (UML 2.0 use case standard)

With the system support for rich text based content management and integration, e-Learning environments such as Moodle can incorporate a diverse set of student activities as shown in the figure 3. Moreover, these activities can be extended easily with additional functions to form comprehensive end-to-end learning processes. On the other hand, 3D MUVE user activities are more abstract and emphasis on 3D simulation and dynamic nature through programming than

advanced textual features. The 3D MUVE student use cases shown in figure 3, indicates this abstract nature and gives a clear view on how difficult to achieve e-Learning use cases as they are, in 3D MUVE.

This validates the proposed blended learning model and the arguments, as 3D MUVE should be incorporated with its competent learning use cases, whilst e-Learning and traditional learning practices being considered for the rest. Moreover, inappropriate use case integration between e-learning systems and 3D MUVE can result to inconsistent data and critical security issues on role based access control. The following section elaborates the use case comparison with a set of unproductive learning features implementation in 3D MUVE through the one-to-one mapping of e-Learning use cases.

Unproductive practices in 3D MUVE

These practices can be seen in two types. First, the popular use cases of using 3D MUVE for trivial learning activities such as mere gatherings or to impose 3D flavour on existing 2D learning contents. However, these activities do not induce additional inefficiencies to learning process, but variety and dynamism, although the learning activities are not practiced to the optimum potential. On the other hand, the second type of unproductive practices is somewhat crucial and can obstruct the other activities, even though these practices are becoming popular.

SLOODLE learning features include 11 activities to map selected Moodle activities such as chat, forum, glossary, choice and content display. Synchronised user communications and Moodle content display in 3D MUVE are rational features that add value to learning. However, using 3D MUVE chat channels to publish student compositions in Moodle forum, glossary and wiki, can be a question as those entries supposed to be with rich text and content, which cannot be supported through 3D MUVE interfaces, at present. Furthermore, asking students to participate in quizzes, assignments and text based learning activities in 3D MUVE instead of Moodle can introduce further difficulties to student work. In most of the instances, students require re-login to Moodle afterwards of their initial submission, to enrich the entries that have been done while they were inside 3D MUVE.

Therefore, trying to achieve all learning use cases of e-Learning systems in 3D MUVE is not advised for serious learning requirements. Moreover, students should be encouraged to use the e-Learning environment for its competent functions while the 3D MUVE for its best functions, in a mutually independent manner. The system infrastructure should ensure the seamless data integration between the environments underneath for a smooth learning experience.

Conclusion and Future Work

Identifying appropriate use cases for learning in 3D MUVE will support the future work of this research. 3D virtual worlds have a great potential for engaging students in innovative, immersive learning environments. With this research, we are looking forward to provide comprehensive security management policies for generic learning requirements in 3D MUVE. The proposed security policy models will be implemented at the application level, independent of the underlying platform constraints to ensure seamless customization and reuse, as required.

This paper has briefly, yet comprehensively, rationalized the use case issues associated with learning in 3D virtual worlds, when users expect identical use cases as they practice with e-Learning activities. Either the situational approaches for utilizing 3D MUVE for learning, or forceful integrations of inappropriate use cases of e-Learning systems with 3D MUVE, would not yield sustainable solutions; this paper has introduced a strategic model to analyze these issues considering prime aspects. The brief analysis on use case comparison here would only guide the

pathway, but further research is encouraged for standardizing and applying productive use cases for various learning requirements with 3D MUVE.

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