A New Teaching Approach in the Study of "Chemical Kinetics" and "Chemical Equilibrium" with the Contribution of Moodle Learning Platform

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Abstract **–In this research a new teaching approach to the study of the "Chemical Kinetics" and "Chemical Equilibrium" modules using a distance learning (e-learning) method is presented. More specifically, educational material was developed and complete experiments were video recorded with a multimedia device (video recorder), relating to the study of "Chemical Kinetics" and "Chemical Equilibrium", which were integrated in an online management course system, Moodle. Examples are given, with the content of the lessons that took place, as well as the results from questionnaires. Lastly, the reference is not omitted, to the benefits that have occurred during the use of the Moodle platform.**

Keywords **–Moodle, online support, virtual environments, learner self-action.**

1. Introduction

In the last years, it is accepted that new realities are emerging at a rapid pace and great progress is being noted in all domains of human activity.

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Nowadays, education faces a major challenge, since it can be assumed that never before, in such a short period of time, it had at its disposal such dynamic technologies as shown in recent years. Information and Communications Technology (ICT) are an important element of the civilization and culture of the modern world and create new demands and challenges in the educational domain, as they offer new ways of learning, informing, communicating and working [1], [2].

The use of ICT in the educational process is a key characteristic in activating the student's interest and creating a positive attitude towards learning. On one hand, there are students who consider the lesson as basic and interesting; however, on the other hand, there is another part of students who consider the lesson to be boring and not especially useful. Therefore, the development of techniques for activating the participation and maintaining the interest of students is necessary. The use of ICT, as well as the existence of video presentations during lessons, figures, gives the student an incentive to create links between existing experience and other unexplored aspects of the subject under consideration in order to understand it in depth.

A learning management system (LMS) provides the structure for the distribution and management of educational content, offering at the same time the evaluation of the individual and total learning goals, monitoring the progress towards these goals and providing the necessary information for the management of the learning process.

There are fundamentally four groups of interest which are directly involved in learning management systems (LMS), but there is also the fifth group involved externally. The four main internal groups are students, professors, administrators and the information technology staff (ITS) (Figure 1).

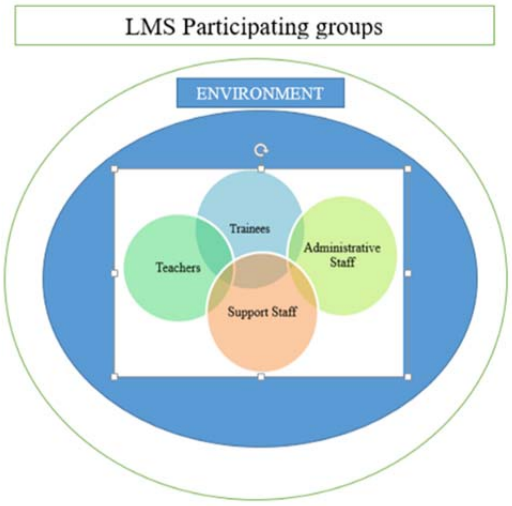

Figure 1. LMS Participating groups

The involving group, indirectly, is the team that will receive the students at the moment of the completion of the educational process. The system uses and examines the results of the learning process, so it is in a position to offer a specific educational level or certification. Each one of these groups has slightly different needs and desires, but they also have some common elements.

Students are the ultimate recipients of the LMS services. They are either on an undergraduate or postgraduate level at the educational institution. They can register themselves in one or more lessons delivered by the LMS.

Professors, more than anyone else, define through their experience the nature of e-learning education, depending on their theoretical background. They play a bigger or smaller role in the determination of the educational experience of the students.

The Information Technology Staff (ITS) are the people that traditionally participate only in the support of the operational side of the LMS.

The administrators in traditional educational institutions are primarily seeking to create an easier access to their Institute and abolish geographical obstacles concerning learners' participation.

The environment (of an LMS) is a mixture of different people, institution and organization that are interested in the results of this e-learning educational endeavor. They cover the various certification organizations that have to certify the quality of the offered directive education.

The categories of teaching management systems for distance learning are two, synchronous and asynchronous education.

In synchronous education, there is a direct relationship between the professor and the student, either through the internet or in person in the same classroom (real time), giving the opportunity to students to exchange views and participate in discussions. The educational process includes all or part of the learning processes.

In asynchronous education the students do not need to co-exist since they can individually choose both the time and the place to learn, collecting the material they wish. This is a flexible way of education that is classified to self-learning and semi-autonomous education. The difference between these two types of education is that unlike self-learning where the learner uses whatever means he/she considers as the most appropriate, in semi-autonomous education, there is a timetable and a professor, with whom he/she communicates, thus having the advantages of synchronous education.

The motivation that triggered the beginning of this research was the students' misconceptions related to issues concerning "Chemical Kinetics - Chemical Equilibrium". This multimedia material aims at a deeper understanding of the educational goals of this thematic unit. As far as it concerns the content of each subunit, particular importance is given to its uniqueness, to the way it is structured, to the language used (if understandable) and of course to the existence of goals in each unit, which are clearly defined so that the student is able to achieve them. The educational goals, whose achievement would be desirable after the completion of the teaching process for this particular subject matter, are the students:

- To describe definitions concerning "Chemical Kinetics" and "Chemical Equilibrium";
- To identify the factors which affect the speed of a chemical reaction and the location of the "Chemical Equilibrium";
- To construct diagrams about "Chemical Kinetics" and "Chemical Equilibrium" in order to respond to the requirements of each exercise;
- To discover through the experimental processes the theory of "Chemical Kinetics" and "Chemical Equilibrium" in order to compare the theory with the experimental result;
- To evaluate the acquired knowledge by solving computational interactive exercises.

2. Methods

The idea of Moodle is based on the fact that knowledge is best conquered when the student interacts with the environment and at the same time reaches for more according to his/her own abilities. The supplement of the learning process occurs when a student composes something new on what he/she has been previously taught. At the same time, the professor integrates his/her achievements into the virtual community and thus is developed community collectivity. The theory of social constructivism is the basis of Moodle. This theory focuses on the importance of culture and the theory of learning in the construction of knowledge collectively, interacting constantly with the environment.

The Moodle is a free learning platform and licensed as an open source software package. Provided to professors, it becomes an easy to use tool which can meet specific requirements and can be supplemented with various functionalities, features and additional supporting material. Another benefit of Moodle platform, is that it can be easily adapted in many educational units and it allows the collection of information, and therefore the enhancement of the services provided through the educational analysis professor [3], [4].

The design of Moodle makes it easy for professors to learn, create online learning communities, control them within the pedagogical principals in order to know the frequency and duration of each student's use, as well as the length of time he/she devoted. This particularity is based on the fact that pedagogical principles were used for its design. It is an assisting tool in the hands of the professor because through related reports he receives he/she can check the frequency of the user's IP in the system.

However, beyond the many advantages of the use of Moodle platform, there are some disadvantages such as low interaction among students which serves as a forerunner for the lack of motivation to acquire new knowledge, a fact that has, as a result, the loss of interest, and consequently the abandonment of the platform, but also the risk of the lack of initiative. Moreover, the biggest threat is the fact that the computer is in danger of becoming the extension of their body. Furthermore, there are some students who do not have the necessary computer skills or the skills required to navigate the platform's educational material.

3. Results

In order to create an innovative teaching method for the unit of acids - bases - salts a relevant multimedia educational website is developed. This material was incorporated into the course management system of the Aristotle University of Thessaloniki for the Department of Chemistry. The theoretical educational material and the multimedia material concerning the two thematic modules of "Chemical Kinetics" and "Chemical Equilibrium", was integrated into the Moodle platform.

The familiarization of students with new technology and the capabilities it provides is being sought, because it offers the ability to work from home; thus having flexibility, an increase of autonomy and a reduction of conflicts between co-students and colleagues.

The theoretical educational material, the experimental material and the interactive exercises were organized into 8 chapters. Students have the opportunity to study in depth the theory of "Chemical Kinetics" and "Chemical Equilibrium".

Figure 2 shows the Moodle window of the course "Chemical Kinetics - Chemical Equilibrium" with all relevant tools in order to modify the educational material, while Figure 3 illustrates the correspondingly webpage for the students.

Figure 2. Snapshot of the Moodle window with the necessary tools, with which the administrator can make various changes

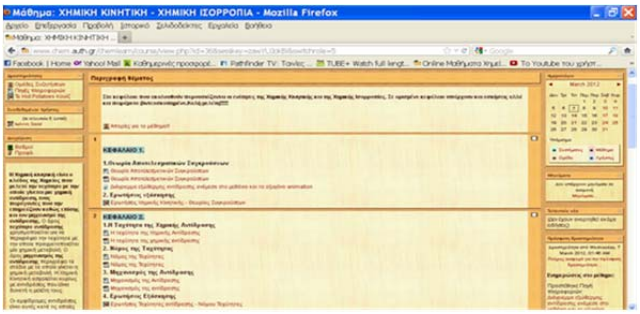

Figure 3. The Moodle window as it appears to the student

The introductive first chapter includes the theoretical teaching material of the effective Collision Theory and their relevance with the achievement or not of a chemical reaction, but also, the training questions for the student in order to be able to confirm the newly acquired knowledge (Figure 4).

Figure 4. Screenshot of the first chapter

The educational material of the chemistry course, "Chemical Kinetics" and "Chemical Equilibrium", has been developed and is available to students in both a printable .pdf format and in the form of a website. Below there is a representative figure (Figure 5) of a Moodle web page about the "Effective Collision Theory", which is covered in the first chapter. Students using the menu of the web page can easily go to the next subunit. The website is set by the professor to open in a new window in the browser used by the students.

Figure 5. The educational material in a website form

In the printable notes, the theory of each unit of the relevant chapter can be found, which is framed by visual representations such as diagrams, images of chemical compounds and reactions in order to give a more attractive character in reading a handbook (Figure 5). In Figure 6 there is a representative figure of the unit "Theory of Effective Collisions" in a .pdf format, which is also incorporated in Moodle.

Figure 6. Course notes in a printable format (.pdf)

In chapter two, concepts are analyzed, such as the reaction rate, the law governing the rate of a chemical reaction and the mechanism according to which a reaction takes place (Figure 7). The reference to the fourth subunit of this chapter, which is about practice questions, should be also underlined here.

Figure 7. Screenshot of the second chapter

In the third chapter, the factors which are responsible for the increase or decrease of the rate of a reaction are analytically referred (Figure 8). In this chapter both online educational material with experimental processes have been integrated and videos showing the relevant experiments. Thus, on the screen of the student, appears the theory in the form of an experimental process. Furthermore, a separate special subunit (subunit 2 of the second chapter) is added at this point, describing the safety rules in a chemical laboratory. Figures 9 and 10 depict representative screenshots from the experimental process and the video of the experiment "Catalytic decomposition of hydrogen peroxide (H_2O_2) by baker's yeast".

Figure 8. Screenshot of the third chapter

Figure 9. The experimental process of the second experiment

Figure 10. Video of the second experiment on "Catalytic decomposition of H_2O_2 by baker's yeast"

In the fourth chapter, students are introduced to the chapter of "Chemical Equilibrium" with ultimate aim the acquiring of knowledge about reversible reactions, dynamic equilibrium and equilibrium constants.

The following chapter (chapter 5) – the concept of Chemical Reaction Performance is being taught (Figure 11). At the end of these chapters, as in all chapters with the theoretical educational material, there are practice questions. These questions are of utmost importance in the process of self-evaluation of students.

Figure 11. Screenshot of chapters 4 and 5

In the sixth and final chapter with the theoretical educational material, there is a detailed description of the factors that affect the displacement of the chemical equilibrium position of a reaction (Figure 12). In this chapter, apart from the practice questions that also existed in the previous chapters, there are three video recorded experiments aiming at the understanding of the theoretical part of the sixth chapter.

Figure 12. Snapshot of the three last chapters (6, 7 and 8)

The seventh chapter contains a glossary of chemical terms, which gives the ability to each student to look up a term faster and more efficiently. Also, in chapter 8 solved combination problems are available in a .pdf file, representative of the chapters of "Chemical Kinetics" and "Chemical Equilibrium", with the ultimate objective of familiarizing themselves with the solution of relevant unsolved problems (Figure 12).

In the articles by Pelayo et al. and Ford et al. [5], [6] make extensive reference to the capabilities of the Moodle platform. The results are comparable with our research. Most participants have given a "good-very good" score on the quality and the usefulness of the educational content, recommending to other colleagues to participate. Furthemore, the integration of platform resources facilitated the learning process [7], [8], [9], [10], [11]. In our research, we focused more on the content of the platform and less on how users view the platform. It is generally accepted that the Moodle platform, which is prevalent mainly in universities, is highly regarded Ford [5], [6] and users are quite familiar with it.

At the end of the second semester (spring semester after the exams) the questionnaire was given to 60 students to analyze the content of the "Chemical Kinetics and Chemical Equilibrium" course. The electronic content of the courses is divided into three categories:

i) in the Content - Teaching Materials which is the main content for the course of "Chemical Kinetics and Chemical Equilibrium";
ii) the educational material is the content that is directly related to the "Chemical Kinetics and Chemical Equilibrium" lesson but is not obligator;
iii) the content supporting material that is not related to the "Chemical Kinetics and Chemical Equilibrium" course but is auxiliary content for chemistry in general.

Figure 13 illustrates that 13% of students do not use information technology in their education process. Usually these students are not offered enough time to their homework.

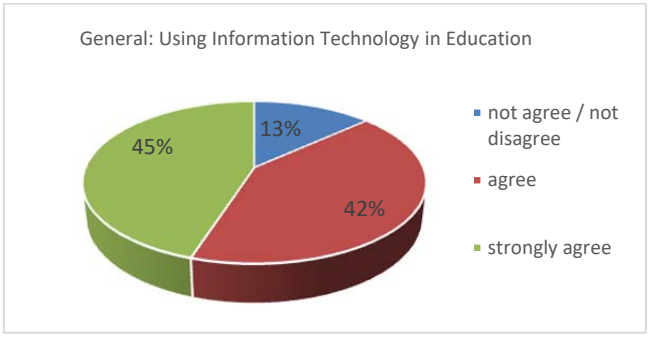

Figure 13. Using Information Technology in Education

Figure 14 depicts that 7% disagree while 23% do not express an opinion; however, 70% has the opinion that the use of information technology minimizes the inequalities between students relevant to teaching procedure. Both 7% of those who disagree and 23% who do not have an opinion is considered quite high.

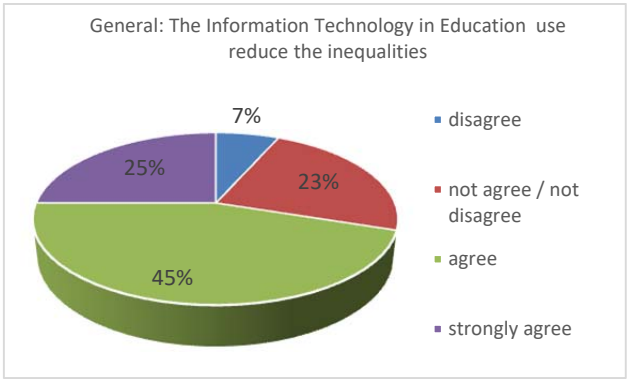

Figure 14. The Information Technology in Education use reduce the inequalities

Information technology has made it possible to digitize many chemistry topics and there is a plethora of applications both for PC (windows 10, ios) and mobile (android, ios). The ability to include video and audio in these applications makes them very attractive. The result is that 83% of the students work on various educational applications on the computer (Figure 15).

Examining the last of the general questions (Figure 16) it is obvious that the percentage of the students who do not want to be related to technology at 15%, while 70% find time to see about with the additional compulsory courses of the e-learning courses. In order to be able to examine the relationship between the content and the material of the courses with the above questions it is necessary to reduce the dimensions (dimension reduction) of the questions. For these reasons we use factor analysis.

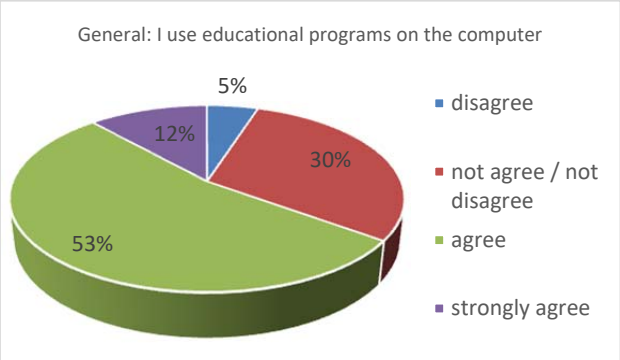

Figure 15. I use educational programs on the computer

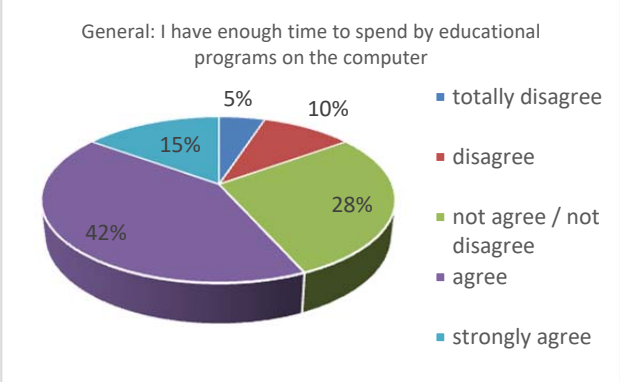

Figure 16. I have enough time to spend by educational programs on the computer

From the factor analysis it can be concluded that students give more weight to the originality of the training material in the category Content - Teaching Materials. In the educational material category, the most interesting session is the solutions of the exercises / examples. Finally, in the supporting material category the highest percentage occurs for the question that the content is clear and at the same time understandable (Table 1).

Table 1. Rotated Component Matrix for the component "Content - Teaching Materials", "Supporting Material", "Educational Material"

Rotated Component Matrix[a]			
	Component		
	1	2	3
Content - Teaching Materials: Includes experiments and theory about "Chemical Kinetics and Chemical Equilibrium".	.736	.326	.191
Content - Teaching Materials: There are patterns and objectives for learning about the topic "Chemical Kinetics and Chemical Equilibrium".	.862	.177	.253
Content - Teaching Materials: Content is unique.	.907	.029	.123
Content - Teaching Materials: Does it include knowledge that is not relevant to the subject of the application?	.831	.265	.272
Content - Teaching Materials: The terminology of the course was understandable.	.850	.072	.251
The educational material that existed in the website helped you: Understand the definitions.	.276	.125	.784
The educational material that existed in the website helped you: In solving the exercises.	.037	.241	.810
The educational material that existed in the website helped you: Understand chemical reactions.	.278	.282	.732
The educational material that existed in the website helped you: Understand the examples of everyday life.	.317	-.070	.629
The educational material that existed in the website helped you: Understand the laboratory experiments.	.530	.353	.582
The educational material that existed in the website helped you: to learn in depth the object.	.641	.191	.542
The supporting material of the educational program was understandable: And its content was aimed at solving problems.	.115	.910	-.006
The supporting material of the educational program was understandable: And its content was clear and at the same time understandable.	.168	.926	.128
The supporting material of the educational program was understandable: Using multiple images.	.156	.915	.258
The supporting material of the educational program was understandable: In its content.	.256	.845	.357
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

The question "The educational material that existed in the website helped them: to learn in depth the object." does not participate in the "Educational Material" factor but in the "Content - Teaching Materials" factor (Table 2).

Table 2. Rotated Component Matrix for the component "Content - Teaching Materials", "Supporting Material", "Educational Material" Without the question «The educational material that existed in the website helped you: to learn in depth the object»

Rotated Component Matrix[a]			
	Component		
	1	2	3
Content - Teaching Materials: Includes experiments and theory about "Chemical Kinetics and Chemical Equilibrium".	**.739**	.325	.200
Content - Teaching Materials: There are patterns and objectives for learning about the topic "Chemical Kinetics and Chemical Equilibrium".	**.859**	.179	.255
Content - Teaching Materials: Content is unique.	**.907**	.031	.126
Content - Teaching Materials: Does it include knowledge that is not relevant to the subject of the application?	**.831**	.266	.277
Content - Teaching Materials: The terminology of the course was understandable.	**.849**	.076	.252
The educational material that existed in the website helped you: Understand the definitions.	.267	.132	**.773**
The educational material that existed in the website helped you: In solving the exercises.	.035	.243	**.810**
The educational material that existed in the website helped you: Understand chemical reactions.	.273	.286	**.729**
The educational material that existed in the website helped you: Understand the examples of everyday life.	.333	-.081	**.658**
The educational material that existed in the website helped you: Understand the laboratory experiments.	.530	.355	**.584**
The supporting material of the educational program was understandable: And its content was aimed at solving problems.	.113	**.911**	-.008
The supporting material of the educational program was understandable: And its content was clear and at the same time understandable.	.171	**.924**	.134
The supporting material of the educational program was understandable: Using multiple images.	.156	**.914**	.260
The supporting material of the educational program was understandable: In its content.	.248	**.849**	.349
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

Table 3 provides twofold information, because it provides two assumptions of factor analysis. It is obvious that the KMO (sample adequacy ratio), which compares the sizes of the observed correlation coefficients, with the sizes of the partial correlation coefficients is 85.4% which means that is acceptable and in a very good level. In the same Table (Table 3), the hypothesis of sphericity is checked and we observe that the initial hypothesis that "H0: All correlation coefficients are NOT far from zero." discarded at the level of statistical significance sig. = 0.000. Therefore, the coefficients are far from being all zero, and certainly another assumption of factor analysis is satisfied. Finally according to the results it can be concluded that the factor analysis is satisfactory and it is possible to continue the statistical analysis.

In the Table 3 there is also the Bartlett's Test of Sphericity, which indicates the presence of correlations between variables. In essence, it gives the possibility that the correlation table has significant correlations between some variables. The sing. = 0.000, so this means that the hypothesis of the absence of significant correlations is rejected at a significance level of 5%.

Examining the correlation of the question Using Information Technology in Education, with the three factors whose results emerge in the Table 4.

Based on the data of table 4 (R Square = 0.505 and sig = 0.000 <0.05) is obvious that the presented results are statistically significant. The Durbin-Watson = 0.829 index approves that the acceptance of independence variable is satisfied [12]. The presented data are for the model which includes all three independent variables. The Goodness of fit R^2 index for this model, typically have values around 50%. In this article these indexes have value equal to 50.5% which is considerably acceptable [12], [13]. The adjusted R^2 index is a correction of R^2. The adjusted R^2 index is 47.9%, which means that the model has acceptable satisfied predictive power [12], [13]. In the penultimate column of table 4 (Sig. F Change), has the significance levels regarding to the values of the statistical F Change. This column specifies the importance or not of the possibly insert of a variable in the model. The statistical significance levels are 0.005 <0.05 hence, the inputs of the variables stated above and, in the order, entered in the model, are considered significant.

Table 3. KMO and Bartlett's Test for the factor analysis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.854
Bartlett's Test of Sphericity	Approx. Chi-Square	807.220
	df	91
	Sig.	.000

Table 4. Model Summary for linear regression for the question "Using Information Technology in Education" and the three factors

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.711[a]	.505	.479	.506	.505	19.058	3	56	.000	.829

Table 5 contains a wealth of information on the coefficients of the under construction regression equation. Column B contains all the information about the 3 parameters of the regression equation, including the constant factor. Thus, constructed reciprocating equation which based on the data of the used sample, and with the assistance of the STEPWISE method, is the following:

Using Information Technology in Education =4.317+ 0.330*Content - Teaching Materials + 0.033* Supporting Material +0.372* Educational Material

Before beginning the interpretation of any regression equation, it is necessary to check the question of collinearity or multicollinearity, and check if the question satisfies the assumptions of regression. If there is violation of the assumption of convergence, then there is automatically correlation among the independent variables, i.e. independent variables correlate with each other. Therefore, it is not possible to compare coefficients when they correspond to linearly related variables. Therefore, it is not possible to compare coefficients when they correspond to linearly related variables. A thorough examination of the assumptions and of course the assumption of collinearity is presented below. The analysis begins with the interpretation of the reciprocating equation, assuming that all assumptions are satisfied.

In the equation it can be observed that, all the coefficients with which the variables are multiplied, respectively, have **positive signs**. This means that the 3 predictor variables **Content - Teaching Materials, Supporting Material, Educational Material,** have a positive effect on the dependent variable **Using Information Technology in Education**. The greatest effect on the dependent variable is exerted by the variable **Educational Material**, as the coefficient with which it is multiplied is the largest (0.372).

From the above equation it is not discriminate which is the most important variable. So we do not know, even from reading the beta coefficients of the variables, which is the 'best' predictor variable. Consider this with two ways:

- With the correct reading of the respective values.
- By studying Partial Residual Plots.

The seventh column of Table 5, the column with the levels of statistical significance (right of the column with the values **t**), does not show the value, or the contribution, of the corresponding variable but if sig is statistically significant for each variable, this is less than 0.05, so all variables are statistically significant except for the **Supporting Material variable**. The contribution of a variable to the model will be judged by reading the column of **t** values. The rule applies: The higher the +2, or the lower -2, is the **t** value of a variable, the greater it is the contribution to the regression model. The result is that all are conventional **(t> 2)** with first the **Educational Material**, followed by **Content - Teaching Materials** with a small difference, while the variable **Supporting Material with t = 0.047** is statistically indifferent [12], [13].

From the Part and Partial Correlation option it comes along the Table 5 (Coefficients), in which there is the correlation of each independent with the dependent variable (Zero-order) and the correlation between the independent and the dependent variable, when the linear effect from the other independent variables of the model have been eliminated (Partial). From the values of the variables and from the Variance Inflation Factor (VIF) column the independent variables do not have linearity - multilinearity.

Table 5. The independed variable correlations for the creation of the regression equation for the variable "Using Information Technology in Education" and the three factors

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	4.317	.065		66.073	.000					
	Content - Teaching Materials	.330	.066	.471	5.007	.000	.471	.556	.471	1.000	1.000
	Supporting Material	.033	.066	.047	.502	.618	.047	.067	.047	1.000	1.000
	Educational Material	.372	.066	.531	5.644	.000	.531	.602	.531	1.000	1.000

In table 6 we have the evaluation of the linear regression model. The check of the significance of the **F** value (F-distribution distribution) of the **ANOVA** (Analysis of Variance) table is satisfactory and considering the sig. <0.05 the results are statistically significant.

Table 6. The ANOVA table for the regression analysis for the variable "Using Information Technology in Education" and the three factors

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.642	3	4.881	19.058	.000[b]
	Residual	14.341	56	.256		
	Total	28.983	59			

From the result of the correlation of the variable ***Using Information Technology in Education*** with the factors **Content - Teaching Materials, Supporting Material and Educational Material** it concludes that students use the technology in education based on the content of the Moodle for material which is general for the chemistry especially when this is simple and understandable.

The model for regression with dependent variable **"The Information Technology in Education use reduces the inequalities"** is presented in Table 7. Compared to the model in Table 4 it is better since the Goodness of fit R^2 index for our model, usually have values 63.5%.

The reciprocal equation from Table 8 for the variable "The Information Technology in Education use reduces the inequalities" is:

The Information Technology in Education use reduce the inequalities = 3.883 + 0.436 * Content - Teaching Materials + 0.330 * Supporting Material + 0.420 * Educational Material

Here, the main factor is ***Content - Teaching Materials***, while all the factors are statistically significant.

Table 7. Model Summary for linear regression for the question "The Information Technology in Education use reduce the inequalities" and the three factors

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.797[a]	.635	.615	.537	.635	32.412	3	56	.000	.900

Table 8. The independed variable correlations for the creation of the regression equation for the variable "The Information Technology in Education use reduce the inequalities" and the three factors

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.883	.069		56.018	.000					
	Content - Teaching Materials	.436	.070	.504	6.235	.000	.504	.640	.504	1.000	1.000
	Supporting Material	.330	.070	.381	4.720	.000	.381	.533	.381	1.000	1.000
	Educational Material	.420	.070	.485	6.007	.000	.485	.626	.485	1.000	1.000

Once again the results are statistically significant as shown in table 9.

Table 9. The ANOVA table for the regression analysis for the variable "The Information Technology in Education use reduce the inequalities" and the three factors

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.037	3	9.346	32.412	.000[b]
	Residual	16.147	56	.288		
	Total	44.183	59			

From the result of the correlation of the variable ***The Information Technology in Education use reduce the inequalities*** with the factors **Content - Teaching Materials, Supporting Material** and **Educational Material** we can conclude that students feel equal, with the mean that provided to them the same knowledge in the same environment with the same rights and this is determined mainly by the content of the course taught through the Moodle.

The model for regression with dependent variable **"The Information Technology in Education use reduces the inequalities"** is presented in Table 7. Compared to the model in table 10 is tolerable since the Goodness of fit R^2 index for our model, have value 47.0%.

The reciprocal equation from Table 11 for the variable "I use educational programs on the computer" is:

I use educational programs on the computer = 3.717 + 0.277 * Content - Teaching Materials + 0.247 * Supporting Material + 0.345 * Educational Material

Here the most important parameter is the **Educational Material**, while all the factors are statistically significant.

Table 10. Model Summary for linear regression for the question "I use educational programs on the computer" and the three factors

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.686[a]	.470	.442	.552	.470	16.584	3	56	.000	.797

Table 11. The independed variable correlations for the creation of the regression equation for the variable "I use educational programs on the computer" and the three factors

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.717	.071		52.186	.000					
	Content - Teaching Materials	.277	.072	.375	3.859	.000	.375	.458	.375	1.000	1.000
	Supporting Material	.247	.072	.334	3.433	.001	.334	.417	.334	1.000	1.000
	Educational Material	.345	.072	.467	4.804	.000	.467	.540	.467	1.000	1.000

The results are statistically significant which is shown in Table 12.

Table 12. The ANOVA table for the regression analysis for the variable "I use educational programs on the computer" and the three factors

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.141	3	5.047	16.584	.000[b]
	Residual	17.042	56	.304		
	Total	32.183	59			

From the result of the correlation of the variable **I use educational programs on the computer** with the factors **Content - Teaching Materials. Supporting Material** and **Educational Material** it is concludes that students use the computer and educational programs to acquire mainly basic knowledge.

The model for the regression with dependent variable "I have enough time to spend by educational programs on the computer" is presented in Table 13. Compared to the model in Table 10 it is better since the Goodness of fit R^2 index for our model, have value 67.0%.

The reciprocal equation from table 14 for the variable "I have enough time to spend by educational programs on the computer" is:

I have enough time to spend by educational programs on the computer = 3.717 + 0.488 * Content - Teaching Materials + 0.371 * Supporting Material + 0.583 * Educational Material

The **Educational Material** emerges as the most important factor whiles all the other factors are being statistically significant.

Table 13. Model Summary for linear regression for the question "I have enough time to spend by educational programs on the computer" and the three factors

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.819[a]	.670	.653	.609	.670	37.968	3	56	.000	.816

Table 14. The independed variable correlations for the creation of the regression equation for the variable "I use educational programs on the computer" and the three factors

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.517	.079		44.740	.000					
	Content - Teaching Materials	.488	.079	.473	6.161	.000	.473	.636	.473	1.000	1.000
	Supporting Material	.371	.079	.359	4.683	.000	.359	.530	.359	1.000	1.000
	Educational Material	.583	.079	.564	7.350	.000	.564	.701	.564	1.000	1.000

Table 15 shows that the results are statistically significant.

Table 15. The ANOVA table for the regression analysis for the variable "I use educational programs on the computer" and the three factors

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42.224	3	14.075	37.968	.000[b]
	Residual	20.759	56	.371		
	Total	62.983	59			

From the result of the correlation of the variable **I have enough time to spend by educational programs on the computer** with the factors **Content - Teaching Materials. Supporting Material** and **Educational Material** it is obvious that students spend time in educational programs with intention to acquire mainly basic knowledge.

4. Conclusion

This paper concerns the presentation of a pilot study which has been created. The results of the pilot study have shown that the knowledge and the process of learning, in general, are conquered more efficiently if the taught thematic units are being framed by a Learning Management System (LMS) which is enhanced by a collaborative learning tool. This paper moves in the context of highlighting the effectiveness of the use of digital interactive means to create scientific insights from the students themselves. In this research, we have designed an educational material, which is a detailed teaching package for professors and students. The platform has full description of the whole learning process of approaching knowledge that concerns "Chemical Kinetics – Chemical Equilibrium", with the intention to be a valuable tool for any professor. Unfortunately, in recent years Chemistry has lost its position in education (particularly in secondary education) due to the decrease of the curricula and the desperately pressing timetable. The result of the above is a broad acknowledgement that the level of knowledge and perception of students in terms of Chemistry is decreasing rapidly. The new teaching procedures such us the use of Moodle platform, come to give a solution to this problem by introducing simulations, videos and images for the better understanding of what is being taught.

The use of the computer is a quite effective tool in the disposal of the professor for the activation and participation in the educational process even among the most indifferent students. There are many available software systems that provide online learning systems. This type of software specifically is expressed by commercial or open source types of software. The present paper focuses on Moodle. Based on students' own views it is concluded that the platform which was used was quite useful as a supportive tool since it offered the potentiality of studying the material without time and place restrictions. Students in the majority described the software as pleasant, easy to use, with very good aesthetics and with high quality presentation tools of the information.

From the results of the statistical analysis it can be concluded that there is a small but not negligible group of students who do not want to engage in e-learning. The majority of students not only works on e-learning but also spend time and in other learning programs with the main ones dealing with basic knowledge. It is typical that if someone want to increase the use of MOODLE and in general the involvement of students with e-learning, it is useful to develop the material that concerns the explanation of the general terms and the basic definitions of the course.

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