

# Exploring Self-Regulation Based Virtual Learning Environments Using Diary

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**Abstract:** *Background:* Virtual Learning Environments (VLEs) such as Coursera, Moodle and edX have become increasingly popular. However, achieving self-regulated learning (SRL) remains an ongoing challenge in current VLEs. Diaries are instruments through which students can reflect on their learning experiences and the use of a diary is important for gathering various kinds of information. Also, diaries help to obtain valid data on daily learning experiences and progress. This paper explores the use of a diary to enhance student self-regulation while learning in a VLE. *Methods:* The experimental period lasted 4 weeks. Participants studied 10 lessons in a VLE with one e-quiz after each lesson. They also interacted with teachers and other students on the Facebook pages. A YouTube channel was used to help students upload their project progress reports (e.g., videos). Only the experimental group participants were using Google forms to write diaries. Every student in both groups answered the questionnaire (pre-test) to identify the (SRL) level of each student and every student answered a post-test questionnaire so we could measure and compare results and relative progress. *Results:* In almost all cases, participants from the experimental and the control groups improved their Self-Regulated Learning abilities in the VLE, however, there was more improvement in the experimental group than in the control group in almost all aspects of SRL. The study indicates that the use of a diary increases the number of correct answers in SRL questionnaires and develops self-regulation behaviour among students above and beyond the level attained when studying in a VLE without writing diary. After analysing 200 diary files from the experimental group students we found that their performances had improved significantly above and beyond the control group results which confirms that writing a diary while studying in a VLE has positive effects on student SRL. *Conclusion:* Writing diaries had a significantly positive effect on improving the students' self-regulation compared with studying in a VLE without writing a diary. There are multiple benefits. Some of these are the sense of personal ownership of design objectives and thus greater motivation to be engaged, personal adjustments made to the study environment, personal planning, the establishment of personal priorities and self-reliance. Diary use also develops the students' capacity for self-accounting. We expect that the use of diaries in virtual learning environments will open up an entirely new range of research issues for educational purposes and for human development.

**Keywords:** Index terms, virtual learning environments, self-regulation, diary.

## I. INTRODUCTION

Nowadays, various educational systems in higher education have adopted Virtual Learning Environments (VLEs). There are also a number of virtual universities such as the Canadian Virtual University, the International Virtual University in the United Kingdom, the Virtual University of Pakistan [54-56]. VLEs can help overcome current traditional system problems such as scheduling, distance and individual differences in academic levels and subject preferences. VLEs [9, 10] are employed to deliver educational resources, to encourage integration between educational components, to save learning time, to reduce student and learning inefficiencies and to facilitate self-monitoring of progress or self-assessment.

The underlying key to the success of VLEs is student self-regulation in planning and time management. Self-regulated learning, by definition, is intended to help students take responsibility for their own learning [27]. Self-regulation [5] consists of behaviour management, self-motivation, cognition and context. These aspects of self-regulation improve the students' ability to learn especially for those seeking higher education.

Until now, self-regulation has been somewhat undefined in VLE studies [13, 28]. As a consequence, some students using traditional VLEs cannot sustain their learning over the long-term (e.g., cannot complete their course). Our study aims to redress this deficiency.

Diaries are instruments through which students can reflect on their learning experiences. Student sentiments, emotions, opinions and attitudes are embedded in their diaries [30]. The use of a diary is important for gathering various kinds of information, e.g., *EDDY* [18], a mobile application,

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in which everyday student life is recorded and can be reviewed.

This paper explores the effectiveness of using diaries to improve student self-regulation in VLEs. We used a questionnaire to assess the students' self-regulation in a control and also in an experimental group before and after using the VLE. We also collected 200 diary entries from 20 students' (in the experimental group). Our results show that self-regulation can be significantly enhanced through the use of a diary in the VLE environment. And in the cases where we asked students to write diaries while learning in the VLE, we believe their progress in self-regulation will be better than those students who study without writing a diary. We conclude by discussing the effectiveness and future challenges of diaries in VLEs.

## II. RELATED WORK

Our paper is related to two bodies of work (i) self-regulated Learning in virtual learning environments, and (ii) the use of diaries in virtual learning environments.

### A. Self-Regulated Learning

*Self-Regulated Learning* (SRL) is a constructive process which improves the student's ability to set learning goals and to monitor, control and enhance their learning, motivation and environment. The process can be guided and constrained by each student's goals [3, 47].

Past works found that SRL in VLE enhances motivation [11, 38], encourages students to engage with all the elements of learning [35], maximizes learning efficiency [42] and provides opportunities for low-achieving students to grow at their own pace [41]. In addition, the learning system helps novices in such a way that they do not need to devote so much time on peripheral problems [15]. SRL also develops the learners' abilities to use personalized e-learning systems. Furthermore, *SRL* helps learners become life-long learners [19].

SRL components are (i) planning, (ii) goals monitoring, (iii) time management, and (iv) self-evaluation [26, 38, 44, 46].

There are many past works on self-regulated learning. Barujel and Groba [6] showed that SRL in social networks encourages students to interact and create a rich learning environment. Also, self-regulation helps novice learners in game based learning environments to devote less time to understanding and solving problems [1]. Nowadays, educational technology can support students to conduct self-regulation [14].

Huang *et al.* [20] found that using self-regulation in the Web 2.0 learning system provides learners with mechanisms for regulating their learning, and supporting knowledge acquisition especially for low-achieving learners. Computer-based learning environments and VLE can be used to support student SRL even if there are differences among learners and task characteristics [43, 45]. Scheiter and Gerjets [36] found that using self-regulation in hypermedia learning environments enables students in the acquisition of Meta skills while learning by providing learner control and feedback.

Despite the potential of self-regulation in VLEs, in traditional VLEs, students were spending almost 70% of their study time reading texts, 11% learning tasks and 12% active and elaborated learning tools, whereas meta-cognitive aids were used less than 1% of the time [32]. Benmimoun and Trigano [7] pointed out the need for an interactive guide on SRL to improve the use of technology in enhanced learning environments.

Montalvo and Torres [29] presented different ways to measure SRL such as using interviews, self-reporting, questionnaires (where the teacher assesses the answers), thinking aloud, error detection in tasks and trace methodologies (where the learner judges him/herself). They also directed researchers to catch the importance of integrated self-regulation within educational contexts and within different subjects. Moreover, many studies ask researchers to perform research into SRL component and Diary [29, 33, 48].

### B. Diary Based on Virtual Learning Environment

Zimmerman showed that self-regulation intervention involving diary logs can be used effectively in classroom training conducted by teachers to enhance students' use of SRL processes and achievements in mathematics [49]. Another study [21] reported that diaries clearly enhance the teacher's teaching practice. Furthermore, diaries help to obtain valid data on daily learning experiences and progress [37].

A diary implies a data gathering method. Using it was a useful tool for learning to construct the students' interactions and communications, thereby enabling the proposed VLE to encourage social relationships among the participants [57]. Another study stated that the teacher availability criteria can be derived from an online diary. It concluded that it is useful to implement an Ad Hoc Transient Communities model in the virtual campus of the Free Technology Academy [34].

By observing the flow of emotions within a diary an instructor is given the opportunity to address any issues or concerns in a timely manner that might be causing negative emotions [30]. One study indicates that keeping a diary has positive effects on time management strategies of pre-service science teachers [2]. Other study recommended to do research introducing feedback protocols such as a combined, choice or control condition and building in a better gauge to track the time, context of changes and to discuss each student's particular interests [8]. A diary, most importantly, provides feedback which is necessary if students are to grow in confidence [12, 31].

Veiza *et al.* [42] presented a study which explores the relationship between the use of a blog as an online diary with social connections and its ability to build social capital in the blogosphere. Kay and Watters [22] used the information collected during the diary study and mentioned that researchers are able to identify how experienced web users perform and clarify multisession tasks by using a diary [39]. Saks and Lejjen explored the future possibilities of trace methodologies which can be opened as new perspectives for understanding and assessing SRL [35].

The above mentioned studies have shown some effectiveness of diary use in educational contexts in improving

student SRL processes. However, most of the studies were short-term studies and have not focused on applying diaries in VLEs. To our knowledge, the present study is the first to explore the effectiveness of using a diary in VLE environments for more efficient self-regulated learning.

### III. METHODOLOGY

Our main question was: How effective is the use of a diary in developing self-regulation in virtual learning environments? Thus our goal was to investigate the use of diaries to support SRL in virtual learning environments. We embedded a form-based diary into the learning environments which students in the experimental group were asked to fill in according to the information specified therein. On the other hand, the control group students' were asked to study the lessons in the VLE without filling in the diary pro-forma. To measure progress in self-regulation, we used a questionnaire.

#### A. Participants

38 university students of the educational technology department were recruited (16 females,  $M=21.0$ ,  $SD=0.012$ ) - 20 students (in the experimental group) and 18 students (in the control group). All had past experience with virtual learning environments.

#### B. Design Criteria

To determine the design criteria of our VLE, we interviewed 132 students from two universities about self-regulation, planning, time management, short and long term goals and self-accounting. We also interviewed 10 lecturers. We also reviewed past works regarding self-regulation [4, 5, 16, 23-25, 44]. The review enabled us to identify a list of design criteria for designing self-regulation based virtual learning environments. This appropriateness and clarity of the list of criteria was revised and confirmed by 9 university lecturers.

#### C. System / Apparatus

The virtual learning environment [57] including the text and multimedia was designed using the Microsoft Expression Web program. Adobe Photoshop Cs 5.0 and 3D flash gallery program were used to design a 3D interface to publish a syllabus about producing 3D-learning objects and I Clone V5.5 software [60]. The syllabus was divided into 10 lessons with one e-quiz after each lesson. This e-quiz was designed using Quiz Maker 2.0 software. YouTube Channel was used to help students upload their progress [61], Facebook page was used to let students interact with teachers and other students [59].

Using Google forms, students wrote their diary feedback after every lesson. Each diary form consists of a 10 question questionnaire. In their diaries they wrote a quiz grade beside each question to measure their progress in self-regulation. The questions were: Choose effective strategies and self-monitor (write your objectives, adjust your study environment, determine the best time for studying), organize academic self-motivation (specify priorities, time management, assessment), planning (planning and time management, rewards, punishment), self-strengthening (self-encouragement,

self-reliance, enforce content relations, self-accounting) [58]. All the aforementioned components were secure and protected from electronically distributed disturbances like announcements, spam and viruses.

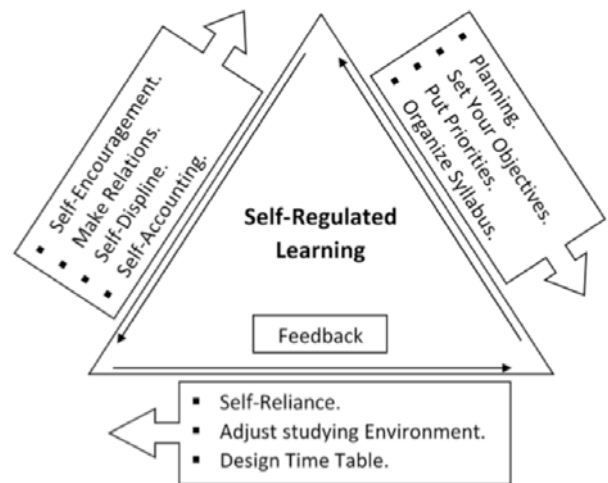


Fig. (1). Self-regulated learning process.

#### D. Measurement Tool

We developed this measurement tool based on Zimmerman's work [48-50], Wolters *et al.* [51], Brak *et al.* [52], and Barnard *et al.* [53]. The questionnaire consist of 53 items to measure four dimensions of self-regulation (planning, goal monitoring, time management, and self-evaluation).

#### E. Procedures

The experimental period for both groups (experimental and control) took 4 weeks. Students studied 10 lessons and thus answered 10 quizzes. Experimental group students wrote 10 diaries. Every lesson had a suggested time for study on the webpage containing the lesson content. Students in the control group did not write a diary. They arranged their time by themselves depending on their general timetable.

1) *Applying the questionnaire (Pre – test)*: Every student in both the experimental and the control groups answered the questionnaire (pre – test) before they started using the virtual learning environment. It was designed to identify the self-regulation level of each student. After answering the questionnaire, students received user an account ID and password.

2) *Lodging the timetable*: Participants from the experimental and control groups read the instructions about how they could use the VLE. They downloaded the suggested timetable for studying the lessons. The timetable, designed in Excel workbook, consisted of 4 sheets, each sheet being used to arrange the student's activities for one week.

The participant put a suitable time for each activity and added or deleted any activity depending on their available time. After that they sent the time table to us for review. Finally we let them use the virtual learning environment. During the study process they could modify the timetable and in that case they sent their revised timetable to us.

The main goal for this step was to help students in the control and experimental groups to lodge their timetables which should now be suitable for their daily activities. This timetable also helped participants in both groups to measure their progress in self-regulation.

3) *Study lessons*: First, the control and experimental group participants studied the lesson. Second, they answered the e-quiz which consisted of 10 to 15 questions. Every question in each quiz contained a picture from iClone V 5.5 software. Students received feedback from the teacher and other student's on the Facebook page. They uploaded video files referring to their progress in YouTube channel. If students did not end the required duties other students asked and encouraged them. Mutual encouragement was consistently promoted. Students who presented good productions on the YouTube channel were asked to share their production methods with other students.

4) *Diary*: Before the course began, we met the experimental group participants to explain how they could write their diaries while studying in the VLE. Experimental group participants wrote in their diaries after every lesson. They used their timetable each time they began writing using Google forms. We downloaded the diary lesson by lesson. In addition to diary information, we added a column to record the time we received this diary (Fig. 2). Participants were encouraged by the teacher to keep writing the diary. In each diary, students needed to fill out 3 input boxes (name, e-mail, quiz grade) beside other boxes aimed at improving self-regulation.

**Diary for lesson ( 9 )**

Name

E-mail

Your Degree in the practice number (9)

Write rewards which you specified to yourself after achieving your goal.

What are the three times you prefer to study?

Establish relations between main idea in the lesson and your experience.

**Submit**

**Fig. (2).** Sample of diary web-page.

Self-regulation activities were written under the following titles: (1) *planning*: students wrote their long and short term objectives, adjusted their study environments, chose the best time to study, planed their studying methods, reported how they encouraged themselves, (2) *goal monitoring*: re-

ported on how they rewarded themselves when they achieved their objectives, reported on ways they disciplined themselves when they did not achieve their objectives, (3) *time management*: students specified their priorities, reported on what how they managed their time, assessed their progress, and (4) *self-evaluation*: what adjustments they made towards self-reliance, what they reinforced and enhanced the relationship between the lesson content and their experience; in brief, each student reported how he/she managed the process.

5) *Apply the questionnaire (Post – test)*: After using the virtual learning environment, every student from the experimental and control groups answered the questionnaire (post – test).

## IV. RESULTS

### A. Questionnaire Results

1) *Control group*: We used 36 questionnaires to measure progress in the development of self-regulation (18 pre – 18 post). The participants answered the questionnaire before and after finishing all lessons in the VLE. We found a significant difference in self-regulation ( $t(18) = 3.037, p < 0.05$ ) and results refer to improve student's self-regulation abilities by studying in VLE (Fig. 3).

Improvement in the control group is due to the freedom students have regarding their study conditions. In the VLE, students freely choose the time and place to study depending on their individual preferences. Furthermore, they can arrange the syllabus and establish their own priorities. Self-reliance and self-accounting are very useful criteria in VLE. Control group students designed their personal objectives, managed their time and studied depending on their own timetables.

2) *Experimental group*: We used 40 questionnaires to measure self-regulation (20 pre – 20 post). In addition, a total of 200 diary files were written by students over four weeks. Each student submitted one diary file after studying each lesson. The total questionnaire results refer to the effectiveness of writing diaries within VLEs in developing self-regulation (Fig. 4).

We found a significant difference in self-regulation ( $t(20) = 6.638, p < 0.001$ ) t-test results which suggested that using a diary in a VLE improves the student's self-regulation ability. We compare also the means of questionnaires in both the control and the experimental groups which use VLE. The results show improved student self-regulation when studying in the VLE with a diary (Table 1).

We collected and analysed 200 diary files (20 Participants  $\times$  10 Lessons). We categorized student diary responses as shown in (Fig. 5).

We compared the development of self-regulation in the experimental group VS the control group: We used 38 questionnaires to measure self-regulation (18 in the control group – 20 in the experimental group).

Questionnaire results refer to the effectiveness of using a diary in VLEs to develop skills such as to improve time management, planning, self-assessment, self-evolution and to reinforce relations between instructional lessons.

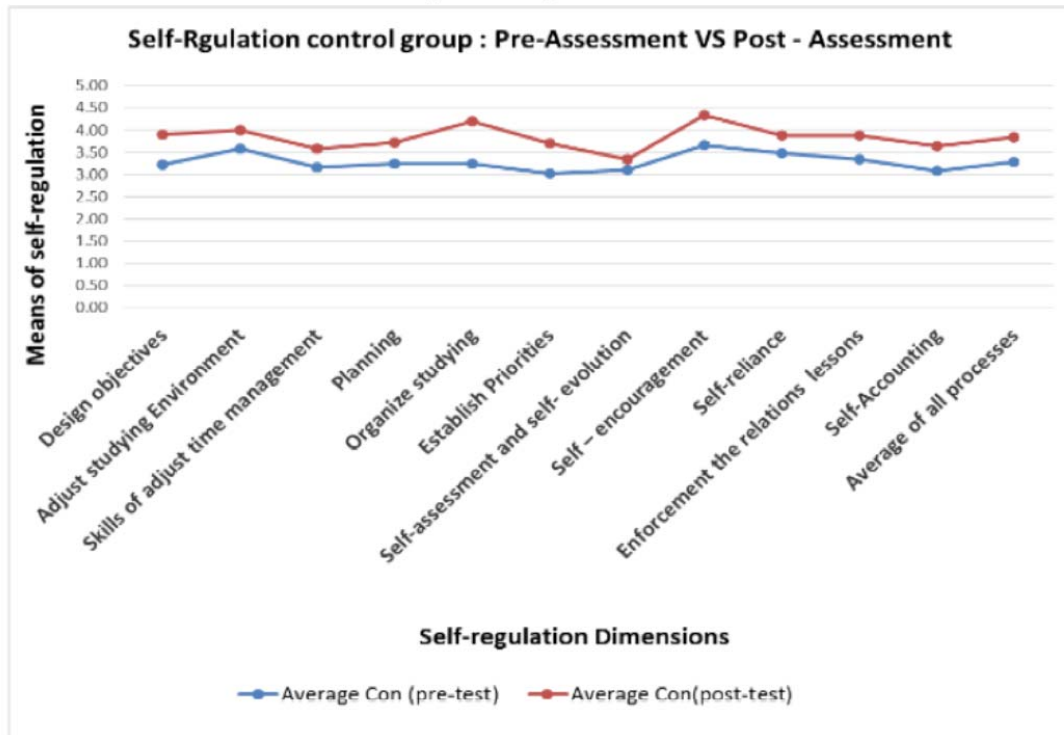


Fig. (3). Develop self-regulation in VLE without Diary.

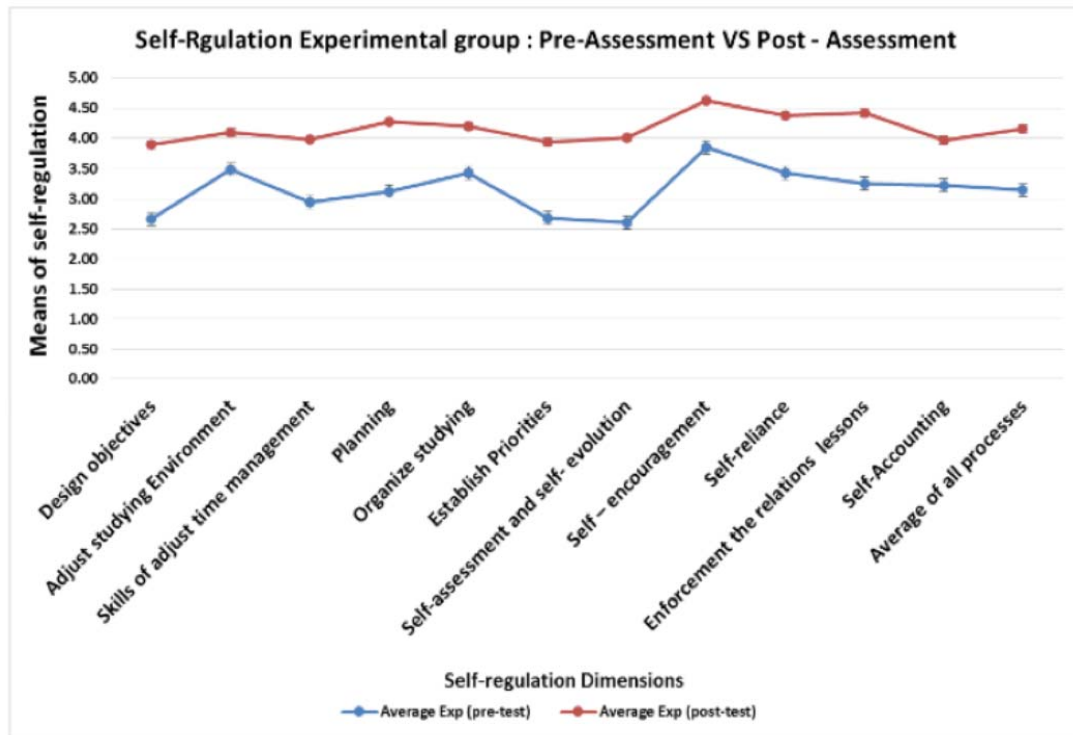


Fig. (4). Using Diary in VLE to develop self-regulation.

We found a significant difference in self-regulation ( $t(36) = 2.412, p < 0.01$ ) t-test results which suggested that using a diary in a VLE significantly improves the student’s abilities

in these dimensions of self-regulation compared to studying in a VLE without writing a diary (Fig. 6).

**Table 1.** Averages differences in self-regulated learning in (pre-post) questionnaire.

Self-Regulation Process	Control Group			Experimental Group		
	Average (Pre-test)	Average (Post-test)	Improvement Percentage	Average (Pre-test)	Average (Post-test)	Improvement Percentage
Design objectives	3.22	3.90	21.03%	2.66	3.89	46.24%*
Adjust studying Environment	3.57	4.00	11.92%	3.48	4.10	17.70%
Skills of adjust time management	3.16	3.58	13.32%	2.94	3.99	35.77%**
Planning	3.25	3.71	14.25%	3.13	4.28	36.80%**
Organize syllabus	3.23	4.20	29.90%	3.43	4.20	22.45%
Establish Priorities	3.02	3.70	22.70%	2.68	3.93	46.58%
Self-assessment and self- evolution	3.11	3.35	7.74%	2.60	4.02	54.49%**
Self – encouragement	3.67	4.33	18.18%	3.85	4.63	20.35%*
Self-reliance	3.47	3.89	12.00%	3.43	4.38	27.74%
Enforcement the relations between instructional lessons	3.35	3.88	15.77%	3.25	4.43	36.15%**
Self-Accounting	3.08	3.64	18.02%	3.23	3.98	23.26%
Average of all processes	3.29	3.83	16.73%	3.15	4.16*	32.14%**

(\*\* SIGNIFICANT DIFFERENCE IN POST TESTS,  $p < 0.01$ , \*  $p < 0.05$ ).

**Fig. (5).** Categorized student's diaries about Self-Regulated learning.

Also, we found a significant difference in self-regulation ( $t(36) = 2.412$ ,  $p < 0.05$ ) t-test results which suggested that using a diary in a VLE significantly improves the student's abilities to design objectives and to self – encourage compared to studying in a VLE without writing a diary.

Total questionnaire results refer to the effectiveness of using a diary in a VLEs for developing self-regulation. We found a significant difference in self-regulation ( $t(36) = 2.412$ ,  $p < 0.05$ ) t-test results which suggested that using a diary in a VLE significantly improves the student's self-regulation compared to studying in a VLE without writing a diary (Fig. 6).

## DISCUSSION

We found that in almost all cases, participants from both groups improved in self-regulation in the VLE by simply checking their progress through the timetable over the four weeks. Our general findings confirm that using a diary while studying in a VLE has positive effects on student SRL. The main reason is that students take conscious personal ownership of the whole learning process and thereby gain a sense of personal sovereignty and achievement due to their own efforts.

Overall, writing a diary improves self-regulation. (Table 1) shows that there is more improvement in the experimental group than in the control group in almost all aspects of self-regulation. But some improvements were not statistically significant such as adjustments to the studying environment. This may be due to the fact that all participant from the two groups live in the same student's house in the university where the choice of study spaces is limited. All participants live on the same level of the facility. Also, in our educational system all students study the same materials with the same content. So, we were not able to find big differences between groups in establishing priorities. For self-reliance and self-accounting there were no significant differences between groups. This may be because all participants are university students in their 4<sup>th</sup> year, living alone in common university housing. Thus, these students have practiced self-reliance and self-accounting for at least 3 years, so we think the diary did not improve their self-regulation significantly. However, the total improvement in self-regulation is significant because writing a diary helps even self-regulated students refine their self-regulation skills.

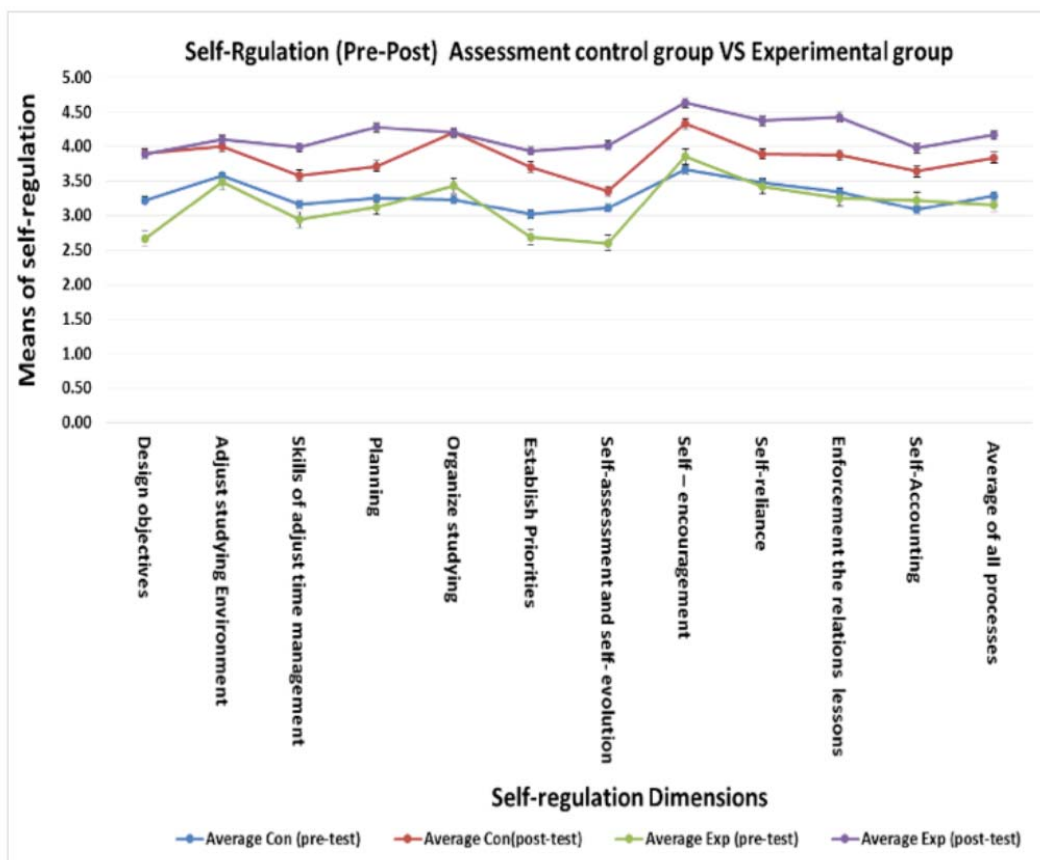


Fig. (6). Develop students’ self-regulation (control vs experimental).

We notice there was a difference in the pre-test between the control and experimental groups. However, it was clear that the control group students scored higher than the experimental group. We also calculated gains in progress regarding improvements in the experimental group which were higher than in the control group. Therefore, we made a t-test for a pre-test to check whether there was any significant difference between the control and the experimental groups. The result ( $t(36) = 0.622, p = 0.538$ ) means the difference is not significant. Depending on the previously stated reasons, we can say that the gap between the control and the experimental groups in the pre-test had no significant effect on the results.

This finding confirms that using a diary while studying in a VLE has positive effects on student SRL. The main reason is that students take conscious personal ownership of the whole learning process and thereby gain a sense of personal sovereignty and achievement due to their own efforts.

We found also that participants who use diaries achieved better progress than participants who do not write diaries. This finding confirms that using a diary while studying has positive effects on each students’ SRL and that students have positive perceptions about the use of diaries [17, 50]. Improvements in each student’s ability have been observed through our study in SRL through VLE. This study indicates that the use of a diary increases the number of correct answers in self-regulation question-

naires and develops self-regulation behaviour among students above and beyond the level attained when studying in a VLE without writing diary.

Writing diaries within proposed VLE enables students to write short and long term *SMART* goals. It also helps students to choose appropriate times for studying on a daily basis. Depending on previous information, students designed their study timetables (about i Clone V5.5) and sent this table to the teacher. Every student received feedback and was allowed to modify their timetable.

After analysing 200 diary files from the students (in the experimental group), we found that experimental group student performances had improved significantly. As an example, 90.91% of the students said "writing diaries made me study the lessons on time, because the times that I had specified for the achievement of my goals were appropriate", 4.55% said, "The videos files make studying easy" and 9.09% said, "I could not finish on time". For seeking help, most students wrote, "they need help from their classmates or discussing with them especially after answering the quiz given after every lesson". Despite the fact that 18.18% reported that they did not need to discuss anything with other students, 63.64% said that "discussion encouraged them to continue studying".

About relating what they learned in VLE and their life experiences, all students presented scenarios in their lives that they need to design using i Clone V 5.5 (the software

they were studying in the VLE). Regarding self-reliance, after 4 lessons students summarized the main ideas they had studied. In addition, all students collected extra data related to each lesson; 9.1% designed and uploaded video files to the YouTube channel even though this was not required of them and they received feedback from other students and from the teacher. This extra voluntary activity indicates a high degree of engagement in the process.

In the last five diary entries, students in the experimental group wrote the reasons they had waste time and they also identified rewards they awarded themselves when they complete the activities. For example some of them wrote: "I would take a vacation with my friends". On the other hand they wrote some activities they preferred but they did not do when they could not follow their timetable. For example one of them wrote: "I did not see my favourite program on T.V".

Almost all students logged into Facebook page for more than three times a day to comment or to "like" videos. On the YouTube channel we could see all students published minimum one video production via *i Clone V 5.5 software*. Furthermore, they started to challenge themselves to know who can produce better designs than others.

## CONCLUSION AND FUTURE WORK

In summary, we have presented a new way of using diaries in VLE. After analysing diary files and student responses in the questionnaires about self-regulated learning, we found that writing diaries had a significantly positive effect on improving the students' self-regulation compared with studying in a VLE without writing a diary. There are multiple benefits. Some of these are the personal ownership of design objectives, personal adjustment of the study environment, personal planning, the establishment of personal priorities, the enhancement of self-assessment and self-reliance. Diary use also develops their capacity for self-accounting. Thus, this study provides clear empirical evidence of the positive impact of using diaries in developing self-regulation.

To our knowledge, the efficacy of using diary in educational virtual systems had not previously been well recognized or evaluated. We expect that the use of diaries in educational systems and especially virtual education environments will open up an entirely new range of research issues for educational purposes and for human development. Our future work will include exploring the effectiveness of using smartphone app for writing diaries with view to developing each student's ability to self-regulate their learning experiences. We will also compare writing mobile phone diaries with website forms and paper/pen diaries. Such comparative studies and evaluations are required to improve diary use in educational processes and in different subjects, further evaluating the student's ability by introducing new methods and also by searching for ways to develop VLE.

## CONFLICT OF INTEREST

The author(s) confirm that this article content has no conflicts of interest.

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