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## The trends in technology supported collaborative learning studies in 21<sup>st</sup> century

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### Abstract

Technology supported collaborative learning, assists individuals to work as a team for a common purpose or mission by using computer, internet and such technologies. For a common mission, active learning should be provided by applying collaborative learning approach. A lot of studies had been done with using collaborative learning. In order to learn the effectiveness of collaborative learning, a variety of studies and techniques should be prepared. Collaborative learning studies support individuals to be learners for a life time. Besides, there exist considerable numbers of studies that were done on the techniques of technology supported collaborative learning. In significant proportion of the presented studies, the online systems have been introduced that were developed for technology supported collaborative learning. In literature, meta-analysis studies were also found related to collaborative learning methods (Jigsaw etc.). When the literature is examined a lot of studies are found related to the particular subject however, there do not exist any recent made researches on the trends of this topic. The main purpose of this study is to determine new trends for those who aim to make research in technology supported collaborative learning, published in popular magazines in the field of education technology between the years 2005 and 2010. Four journals had been chosen in the study to be identified within the scope of SSCI from EBSCO database. 114 studies have been attained after the scan made on SSCI covered journals published between the years 2005 and 2010. The reporting of the study was grouped according to following criteria; publishing year of the finding, article number (of the journals), number of authors, research field, techniques, study environment, research country (sampling group), study model, number of references, researchers' county, the number of studies made with the researchers from different countries, type of the study (qualitative/ quantitative) and so on.

**Keywords:** Technology supported collaborative learning, (TSCLE), Meta analysis, collaborative learning

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## 1. INTRODUCTION

Increasing demand for education and quick proliferation of the information amount has caused computer and internet to take place in education (Wurst et al. 2008; Boukas et al. 2009; Bijedic & Hamulic, 2009; Caglar & Demirok, 2010; Hursen et al. 2011; Uzunboylu & Ozdamli, 2011; Girgin, Kurt & Odabasi, 2011). Computers in education can be used for many purposes such as; school administration, guidance services, research, assessment, and teaching and so on (Keser, 1988).

Internet based educational applications allows geographically distant individuals to share information and ideas and provide constructivist learning environment, collaborative learning and self-learning. Individuals are able to make projects in their respective fields and they can work together, even if they are away from each other. Individuals can create written, voice and video communications via internet. Besides, it is not necessary for the educators and students to stay in the same environment, in addition to this the time limitation is eliminated by web-based education.

The cost of building is also decreased when the lecture halls are not needed. This allows students to work together and generate projects by using computers and internet aided environments. Qualitative studies should be prepared in order to get successful results. Technology supported collaborative learning, assists individuals to work as teams for a common project or task with getting good use from the technologies such as; computer, internet etc.. For a common purpose, active learning is generated by working with collaborative learning approach (Dillenbourg, 1999; Van, Merriënboer & Paas, 2003). However, students might not provide equal participation in computer based collaborative learning environment. Computer based collaborative learning used to be applied in the class environment, however today; web-based is applied more. Students' capabilities, social and ethnic backgrounds and genders may be the factors for active participation of the students' in the environment as it is in other educational fields (Prinsen, Volman & Terwel, 2007). Many studies were done related to collaborative learning in a lot of fields (psychology, sociology and socio-cultural). In order to determine the effectiveness of the collaborative learning, researches in different fields and different research methods are required (Hmelo-Silver & Rainer Bromme, 2007). Also, collaborative learning studies support individuals to be lifetime learners (Nevgi, Virtanen & Niemi, 2006). Lifetime learning, distant learning and informal learning are the three main aspects of web-based collaborative learning (Jianhua & Akahori, 2001). Many studies have been done with different methods related to technology supported collaborative learning (Gogoulou, Gouli, Grigoriadou, Samarakou & Chinou, 2007; Huang, Huang & Hsieh, 2008; Huang, Chen, Chen, 2009; Kao, Lin & Sun, 2008; Zhi & Liu, 2007; Vasiliou & Economides, 2007). The study made by Lou, Abrami & d'Apollonia (2001) has compared computer based collaborative learning with individual workers and in consequence small groups demonstrated more positive results compared to individual workers. With the generated heterogenic groups by Huang, Chen & Chen (2009) a discussion environment is created over Moodle system and it was clarified that students got affected positively from this study. Huang, Huang & Hsieh (2008) made investigations about the integration of digital note taking (mobile annotation) systems into collaborative learning. In the study, it was attempted to create collaborative environments with using one of the collaborative learning methods 'Jigsaw', wireless communication tools and digital note taking systems. Collazos & et.al (2007) mentioned

that the aim of the studies done by them was to provide the learners' learn of collaboration and learning collaboratively.

In most of demonstrated studies, online systems have been introduced for technology supported collaborative learning activities (Gogoulou, Gouli, Grigoriadou, Samarakou, & Chinou, 2007; Hernández-Leo & et.al. 2006). Moreover, in literature, meta-analysis studies were also found related to collaborative learning methods (Jigsaw etc.) (Dillenbourg, Baker, Blaye & O'malley, 1996; Johnson, Johnson & Stanne, 2000; Cavanaugh, 2001).

As it is mentioned above, a lot of researches were carried out for various reasons related to technology-supported collaborative learning activities. Many studies related to this subject were encountered when the literature is examined; however there are no recent made researches on the trends of this topic. Popular journals within the scope of SSCI, (British Journal of Educational Technology, Computers & Education, and Computers in Human Behaviour, Education Technology & Society, and Learning & Instruction) have been chosen and analysed with the aim of guiding those intending to make research related to technology supported collaborative learning. It is expected that this would help researchers, who aim to work in this area, to determine the progress direction, choice of research methods, disciplinary areas, environments and other elements.

### **1.1. Aim**

The general purpose of this study is determining new trends in collaborative learning studies published in popular journals in educational technology area between the years 2005 and 2010 for the researchers who intend to make a study in technology supported collaborative learning area. In order to achieve the above purpose, an answer is going to be sought for the question "What are the features of collaborative learning?" in scope of chosen EBSCO and Science Direct journals. In addition, this research aims to guide all researchers working in the field of cooperative learning.

## **2. METHOD**

This research, made in terms of assessing content analysis of technology based collaborative learning studies, is a documentary review work type.

The journals; British Journal of Educational Technology (BJET), Computers & Education (CE), Computers in Human Behaviour (CHB), Education Technology & Society (ETS), Learning & Instruction (LE) have been selected for this study from the data bases of EBSCO and Science Direct. During the scan of electronic databases, the names of the journals limited with the words; year 2005, 2006, 2007, 2008, 2009, 2010 and working title, key words; collaborative learning. The criteria taken into account for the content analysis by researchers are shown below;

- Publication year
- Number of articles according to journals
- Number of authors

- Research field
- Method
- Working environment
- Sampling group
- Education levels
- Sample size
- Number of studies made together by the researchers from different countries
- The country of the study
- Data collection tools
- Number of references

### 2.1. Data analysis

Before examining the studies scanned from electronic database, researchers generated a database for saving determined criteria and for the use of analysis by using Microsoft access program. The data obtained from detailed document analysis was saved for each of the articles. The data grouped and reports prepared according to established criteria by using query features.

## 3. RESULTS AND COMMENTS

114 studies have been reached, as a result of the scans within the scope of SSCI journals, published within six years, and the results were reported according to chosen criteria. The results obtained from the analysis for each criterion are demonstrated with following tables and graphs.

### 3.1. Publication Year

The number of the studies made related to technology supported collaborative learning is grouped for each year and illustrated in following graph.

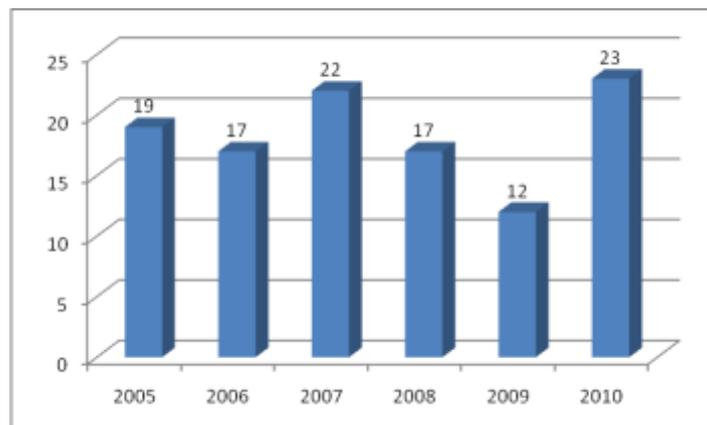


Figure 1 the articles within the scope of SSCI according to years

As it is seen in the graph, most of the studies on technology supported collaborative learning in the journals within the scope of SSCI were made in 2010, and an extensive place has been given to TSCL studies for each year.

### 3.2. The Number of Articles According to Journals

The results for the grouping made with the aim of examining in which of the many journals given place to TSCL studies, have presented in the figure 2 below.

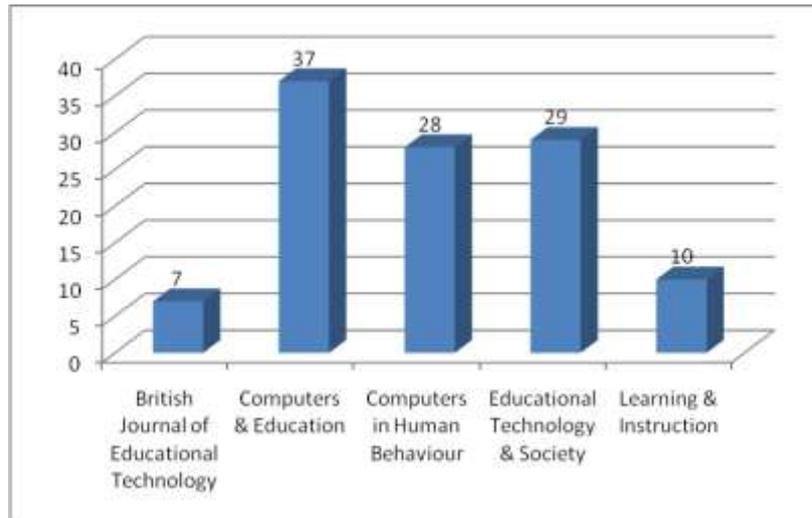


Figure 2. The number of articles according to journals

As it could be seen on the graph, the journal which gave place to TSCL studies the most in last six years was Computers & Education. As for the journals British Journal of Educational Technology and Learning & Instruction, they published just seven studies related to the subject in last six years.

### 3.3. Number of the Authors of the Studies Reviewed

As the subject is technology supported collaborative learning, it needs to be checked whether the researchers, who made investigations on the topic have cooperated between each other or not.

Table1 the author number of the studies according to years

Number of authors	2005	2006	2007	2008	2009	2010	Total
1	2	1	1	1	1	4	10
2	6	9	7	5	4	7	38
3	3	3	3	7	5	4	25
4	2	3	9	2	1	6	23
5	5	0	1	1	1	0	8
6	0	1	0	1	0	1	3
7	1	0	0	0	0	0	1
8	0	0	1	0	0	1	2

As a result of made analysis, it was emerged that 2-4 researchers worked together in last six years as it could be seen in Table 1. The number of individual studies was ten. This finding could be interpreted as, researchers' who made studies relevant to the subject of cooperative learning, collaborated with colleagues.

### 3.3. Research Subjects of the Studies Reviewed

The researchers' studies were grouped by topic. The studies entered into pre-defined topics are given in table 2. The study topics which numbers are more than one are grouped in the following table. The studies which their study topics are made only one time are gathered in the group under the name of 'other'. The studies under the name of 'other' were; data equivalence, the cooperation between European Union researchers, system evaluation, education technologies in primary schools, communication, circulation models, collaborative studies' searching system, problems with online learning, system based evaluation, collaborative model development, lifetime learning, wiki, games, personal answer systems, online discussion tools, music education, motivation, science teaching, friend evaluation, data management and active learning.

Table 2 the Studies according to research subjects

Study subject	Numbers
Web based	35
Computer supported	23
Social relations	10
Asynchronies tools	8
Synchronies tools	7
Software development	6
Mobile learning	4
Video conferencing	3
Group features	3
Other	15
Total	114

As shown in Table 2, most of the studies in the last six years were done on the subjects' Web-based collaborative learning and computer-aided collaborative learning. Another remarkable point was the intensity of the studies done with social relations and asynchronous communication tools compared to other studies.

### 3.4. Research Methods in the Studies Reviewed

As a result of the made groupings, the preferred tools in the reviewed studies are shown in table 3. As it is shown in the table, there has been an increase in the number of experimental studies after the year 2005. The experimental and literature reviews take place the most among all the methods.

Table 3 the preferred research models by years

Research Method	2005	2006	2007	2008	2009	2010	Total
Experimental	17	15	16	14	11	18	87
Review	1	0	2	2	0	2	7
Discussion	1	0	0	0	0	3	4
Descriptive	0	0	1	1	0	1	3
Other (scale develops...)	0	2	3	0	0	1	6
Total	19	17	22	17	11	25	114

Alper & Gülbahar (2009)'s study indicated that most of the studies are in the type of literature review (74) and descriptive. In contrast to studies conducted in Turkey and Cyprus, the number of studies done with scanning method (descriptive) within 4 years was just two.

### 3.5. The Working Environments of Reviewed Studies

As it is known, today a lot of environments are being created and many studies have been done for the applicability of them in order to perform learning. Today, there is a rapid transition is seen towards digital media from traditional class environments. The most important point that should be focused on is environment, for technology supported collaborative learning. It was seen that, the Web-based environments and technology supported collaborative learning class environments are used the most according to the results of reviewed studies that are carried out to determine the preferred environments for technology supported collaborative learning.

Table 4 the annual distribution of preferred working environments

Working environment	2005	2006	2007	2008	2009	2010	Total
Blend (Web-class)	1	1	0	2	1	4	9
Class environment TSCL	4	3	4	4	4	5	24
Web based	10	10	11	9	4	10	54
Mobile environment	0	0	2	0	2	0	4
Other	0	1	0	2	0	0	5
Total	15	15	17	17	11	19	94

As seen in Table 4, there are 2 studies made in 2007 and 2 other made in 2009 related to mobile learning environments. Because of the reason that, mobile learning environment is a new environment, there are not many studies on this topic. As a result of demonstrated increase in applications of mobile learning recently, it is thought that the topic Mobile supported collaborative learning will be explored more into the later times

### 3.6. The Sample Groups of Reviewed Studies

Considering that the data collection for technology based collaborative learning studies should take place at the centre of education by consulting students, only in 77 of the studies applied to students out of 88 made studies for data collection.

Table 5 the preferred sample group

Sample group	Number of articles
Student	77
Teacher	4
Student and teacher	4
Family	1
Experts	2
Total	88

Anastasiades, Vitalaki & Gertzakis (2008) consulted to the views of family in their studies made with primary school students by using interactive video conference system for cooperative learning activities. For younger students, the effectiveness of the studies could be provided by referring to the views of parents and teachers.

### 3.7. The Education Levels in Examined Studies

The target audiences' characteristics are considered while selecting method- technical, environment, etc. Arranged environments might not be suitable for all the levels of education. In the table shown below (Table 6) the education levels in made studies are demonstrated.

Table 6 the distribution of educational levels according to years

Education Level	2005	2006	2007	2008	2009	2010	Total
Primary school	4	1	1	2	0	3	11
Secondary school	2	1	2	2	1	2	10
High school	0	0	1	2	0	2	5
University	7	12	11	11	10	8	59
Master's and doctoral	0	0	0	1	0	1	2
Total	13	14	15	18	11	16	87

As seen above, for each year of the last six years, the university level students is more preferred for technology supported collaborative learning studies compared to other levels. el students for each year in the last six years. As a result of made analysis, it is seen that only one study was made (Overbaugh & Casiello, 2008) with graduate and doctoral level which was in 2008.

**3.8. The Sample Numbers of the Studies Reviewed**

The analysis made for examined studies’ samples between the years 2005 and 2008 was given in table 7.

Table 7 the annual distribution of preferred sample size

	2005	2006	2007	2008	2009	2010	Total
1-29	2	3	4	2	3	3	17
30-59	4	3	2	4	1	4	18
60-89	1	2	3	4	0	3	13
90-119	2	2	1	1	4	1	11
120-159	0	2	1	1	1	2	7
160-200	0	0	2	2	0	1	5
200 ->	2	0	2	0	3	4	11
Total	11	12	15	14	12	18	82

According to conducted analysis between the years 2005 and 2010, the preferred sample size for studies was mostly becoming from 30-59 and 1-29 group members. In particular when it is thought that the necessity of experimental studies is 15 people in each group, the reason is apparent why 30-59 person groups are preferred in the studies. In the last six years, only eleven studies’ sample size is 200 and over.

**3.9. The Number of Studies Made together by the Researchers from Different Countries**

When the opportunities are examined offered by technology, obviously co-operation is not behind closed doors anymore, it is now independent of time and place, and consequently people are able to cooperate with other people at the other end of the world via internet. The analysis made in order to examine whether researchers from different countries collaborated or not is shown in Table 8.

Table 8 the studies made together by the researchers from different countries

Number of Countries	Number of Studies
1	102
2 and over	12
Total	114

When the different country researchers’ studies were examined, which were carried out collaboratively, it is emerged that 102 of the studies conducted by single countries researchers’ and only 12 of the studies were carried out together by the researchers from different countries.

### 3.10. Studies by Countries

When it is tried to answer the question; “In which of the countries the technology supported collaborative learning studies were made the most?” the Table 9 is proving that Netherlands takes the first place.

Table 9 The number of studies by countries

Country	Article	Country	Number of Articles
The Netherlands	18	Israel	2
Taiwan	15	Colombia	1
Finland	9	Fiji Islands	1
USA	7	India	1
Spain	7	Ireland	1
Italy	6	Switzerland	1
Australia	6	Japan	1
Greece	6	Malaysia	1
Chile	5	Norway	1
Canada	5	Plymouth	1
Germany	4	Cyprus	1
Singapore	4	Slovenia	1
Belgium	4	South Africa	1
Turkey	3	Sweden	1
UK	3		

The other countries which made the most researches related to the particular subject are Taiwan, Finland and USA. In Turkey, the number of technology supported collaborative learning studies that were published in the journals in the last six years was three (Akpınar & Bal, 2006; Serce & Yıldırım, 2006; Bulu & Yıldırım, 2008). According to the conducted analysis, there was any research on this subject made by Turkish Cypriot researchers; however there was just one study, presented by Greek Cypriot researchers.

### 3.11. The Data Collection Methods in the Studies Reviewed

The data collection methods were also investigated in this study. The methods for data collection generally changes according to the study aim. The analyses made related to the methods for data collection were illustrated in Table 10.

Table 10 the annual distribution of preferred data collection methods

Data Method	Collection	20						Total
		05	2006	2007	2008	2009	2010	
Interview		1	2	1	4	2	3	13
Survey		2	3	7	9	10	3	34
Pre-test-Post-test		5	5	2	2	0	5	19
System Tracking		4	4	7	3	2	6	26
Success Test		0	2	1	2	1	3	9
Video Records		1	0	1	0	0	2	4
Observation		0	2	0	0	0	0	2
Other		0	3	0	1	0	0	4

It could clearly be seen that the most used method for data collection in the last six years was survey. The survey method had been started. The use of survey started to be more preferred after 2007 but decreased again in 2010. The least used method for data collection was observation. The time might be consumed until the reliable data is collected and also the observer might be prejudiced while taking notes. Besides, if the observer is noticed, the targeted audience is likely to make change in behaviour.

### 3.12. The Number of References

One of the most remarkable points considered while assessing a study is the richness and quality of the literature. Figure 3 shows that the numbers of references increase over the years.

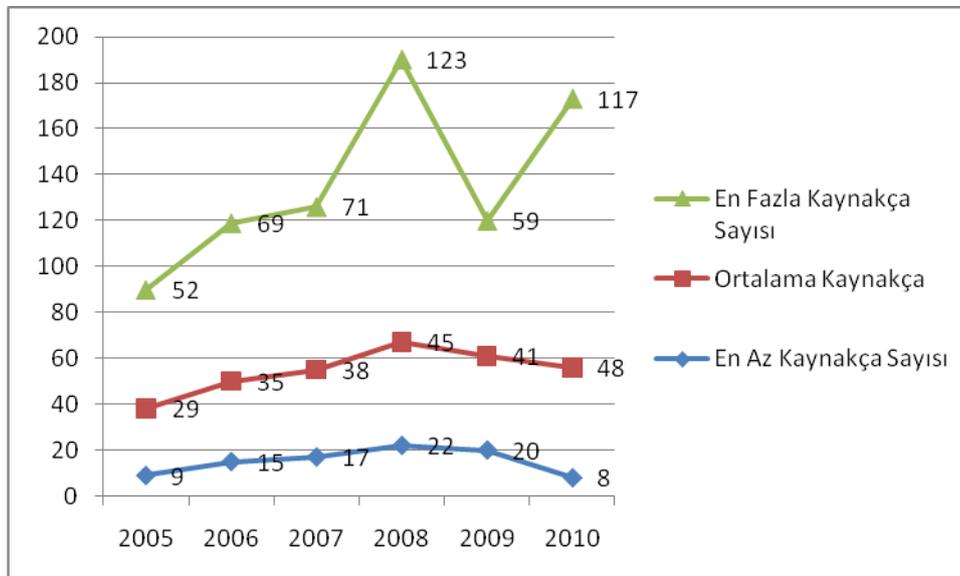


Figure 3 the annual distribution of number of used references

These results are highlighting that the importance of literature is increasing with each passing year. In 2010, the average number of references is 48. On average, in each article 48 sources are utilized.

#### 4. RESULTS AND DISCUSSIONS

The collaborative learning approach is not new. It has been years that collaborative learning based teaching and learning environments are arranged. The collaborative learning environments have begun to demonstrate changes by introduction of computers, internet and mobile technologies into our lives. In order to reach the aimed point in education, these significant changes should be followed by teachers, academics, researchers and of course the students. Many important points achieved at the end of this study that was made with the aim of meeting the mentioned needs. 114 technology supported collaborative learning studies have been attained after examining the journals published in the last six years. In the journals reviewed, a place is given to technology supported collaborative learning studies for each year. Accordingly this is confirming that the technology supported collaborative learning environments are being used and continuous innovations gave rise to new researches.

The journals that gave place to TSCL studies the most between the years 2005 and 2010 were Computers & Education, Education Technology & Society and Computers in Human Behaviour. Based on the results obtained, it is possible to say that these three journals have paid more attention to technology supported collaborative learning studies. A broader place might be given to this subject due to the scopes of journals.

When the study subjects are examined, the web-based collaborative learning and computer based collaborative learning related studies researched the most as mentioned before. Due to the technological advances, computers and internet cannot be separated from education at this time. Computers and internet cannot be separated from the education at this time where there are technological advances. It is possible to meet the needs of students by this way. Also it is clear that, the number of studies made with asynchronous communication tools is more, compared to the studies made with synchronous communication tools. In the last six years, the researchers focused on asynchronous communication tools. The number of studies conducted with video conference system was really small. The studies made with synchronous communication tools require more time and it is harder to keep under control comparing to asynchronous communication tools. A deep attention is seen towards mobile learning in education technologies (Çavuş & İbrahim, 2009; Uzunboylu, Çavuş & Erçağ, 2009; Yau, Gupta, Karim, Ahamed, Wang & Wang 2003). However, according to the analyses carried out, it was demonstrated that the studies; mobile learning and collaborative learning were investigated four times in the last years of considered six years. The reason for this might be the new introduction of mobile technologies and the difficulty in providing the necessary technologies.

According to the results, the most preferred method for researches is experimental studies. It is obvious that researchers find experimental study results' more reliable. Consequently, this is

illustrating that the possibilities for researches are at adequate level in the countries where the researches were conducted. The most preferred environments for the studies were web-based and technology supported collaborative learning class environments. The blended method was used only in nine of the studies. So, most of the studies were accomplished either in web-based or class environments.

The students were consulted for data collection almost in all of the studies. In addition, the most preferred research level was universities. However, there exist various convenient collaborative learning methods for young students. The number of studies made for primary and secondary school were found insufficient. The reason why the researchers chose to study in universities might be the available facilities.

The 39-50 person groups are preferred as the sample size for made researches. The number of studies with large sample group is really small. As described above, most of the studies have chosen experimental methods for the researches. Accordingly the chosen experimental studies are affecting the size of sample. It is reasonably difficult to control sample groups with high number of people when conducting an experimental study. However, the preferred sample numbers are sufficient according to the pattern of the work.

In order to create high quality studies, the researchers required to have a deep knowledge on the research area. More qualitative products are produced when individuals make use of the deep knowledge of others by working collaboratively. According to the obtained results, researchers worked collaboratively rather than working individually. When the made observations are taken into account, the number of articles belonging for a single researcher is just ten. As a consequent of it, researchers should collaborate with other researchers in order to produce high quality studies. The number of the studies made with researchers from different countries is showing an increase; in consequence this is indicating that individuals are able to collaborate even if they are far away from each other by advanced internet technologies.

As for the records used for data collection in the analysis, the surveys and system records are used the most. As for data collection, the researchers mostly used survey and system records; on the other hand the least preferred method was observation. Analysis could be obtained automatically from system records. By using this way, the time is saved and researchers could focus more on studying environments.

When the references are reviewed an increase is seen for each year in the number of references. More reliable results are provided when the studies are supported with literature references. A certain quality was obtained in the studies.

The results obtained have a guiding nature for future studies. The required criteria and lacks for the studies in the field could be obtained by following up the study results.

In order to provide more effective and efficient studies in the field, the suggestions demonstrated below could be taken into account:

- The publication possibility of the studies increases if the works are sent to the journals that give place to TSCL studies in large extent.
- There exist a lot of web-based collaborative learning studies and a lot of studies made in class environment in the field of TSCL, so that instead of making research on these topics the subjects cooperative learning and mobile learning studies made with synchronous communication tools could be researched which were not investigated sufficiently.
- Further studies to be made should be also towards formal and non-formal educational institutions not only for universities besides a case study should be applied for all of these specified institutions in order to produce solutions for problems.
- With distant education technologies, face to face education and blended learning could be applied together.
- When a study is prepared related to young age students, the teachers and families should be preferred rather than students in order to collect data.
- Sample groups should be preferred in studies with the aim of representing the universe.
- Researchers in different fields and countries could conduct researches by collaborating and sharing information of each other.
- The results and theoretical foundations attained from the researches should be supported by the literature.
- The studies made with video conferencing systems and other real time communication tools should be encouraged.
- There might be personal factors that could affect the results of technology supported cooperative learning studies. Thus, the relationship between the results of the study and variables such as; gender, age, socio-economic status etc. could be considered.
- More attention should be paid for the studies related to group characteristics. Accordingly, the homogeneous and heterogeneous group characteristics are considered while choosing the appropriate group type for the study. Besides, ideal group size for the web environment should be investigated.
- The researchers living in Cyprus should be encouraged to perform technology supported collaborative learning studies.
- The facilities should be provided by institutions in order to present experimental studies in Turkey and Cyprus.
- In this study, the groupings made according to the years, for the future groupings could be made according to the journals, also other popular journals in the field could be incorporated into the data analysis.

- Given importance to the content analysis while doing scientific studies in also other fields, and presented scientific studies in this direction would guide other experts who would work in this field.

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