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# Effect of Web 2.0 Technology-Based Instruction on Collaboration Skills of XI Graders

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**Abstract**

The present study aimed to compare the effect of Web 2.0 technology-based instruction and conventional chalk and talk method on collaboration skills of 141 XI graderswith two different learning approaches viz. deep learning approach and surface learning approach in political science classroom. The data collected was analyzed with the help of two- way Analysis of Covariance. The major findings of the study revealed that i) students when exposed to web 2.0 technology-based environment exhibited statistically significant higher collaboration skills than students taught through conventional chalk and talk method. ii) Deep and surface learning approaches do not account for difference in collaboration skills. iii) No significant interaction between treatment and learning approaches was found.

Key words: web 2.0 technology-based instruction, collaboration skills, learning approach

## Introduction

Around 2005, a new range of technologies described as web 2.0, began to find their way into general use and subsequently into the instructional use also. Web 2.0 technologies like blogs, wikis, podcasts and the RSS web feeds engage students to utilize variety of cognitive skills in order to perform and solve problems in this digital atmosphere. These skills can be referred as digital literacies (Gilster, 1997; Inoue, Naito &Koshizuka, 1997). Recent years have witnessed a growing awareness in the newest generation of Web 2.0 based tools namely wikis, blogs, social networks, podcasts etc. (Perumal & Vinothkumar, 2022) as evidenced by the growing number of publications on the subject and the many examples of online educational services that have adopted the use of these tools. It is also called transparent technology as user does not require high technical skills to use these features (Wheeler, Kelly & Gale, 2005). The user is able to concentrate more on the learning task by seeing through the technological environment they are immersed within (Boulos, Maramba, & Wheeler, 2006). Web 2.0 smoothened the progress of sharing information, creativity and collaboration between users.

Web 2.0 impacts on four principal dimensions of the learner's experience viz. collaboration, publication, literacies and inquiry.Collaboration and publication are social in nature and literacies and inquiryare cognitive in nature (Selwyn, 2008). Collaboration Web 2.0 allow the learners to coordinate their activities by participating or giving their opinions by the way of written communication. Web 2.0 tools support collaborative form of learning and is more oriented to the building of classroom communities just like professional communities. "Publication The read-and-write character of Web 2.0 supports the learners in creating original material for publication. Literacies As learners engage with digital items through Web 2.0, their confidence with new literacies is developed and thus in further their creative potential is increased. Inquiry Web 2.0 technologies offer new ways and means for learners to conduct personal research. It creates new structures for organising data, new sources to refer to, new experts to interrogate enriched information" (Selwyn, 2008).So, Web 2.0 technology engages the learns cognitively as well as socially. When used in classroom, Web 2.0 tools can transform the class room into collaborative one constructed by using wikis, blogs, podcasts, and other social web tools, that demand dynamic content generation "which may comprise of reflections and conversation, hence requiring collaboration and interaction" (Richardson, 2009). Web 2.0 technologies enhance students' language learning abilities (Roy, 2023) and academic performance (Sonmez & Cakir, 2021).It empowers the teachers and in turn teachers can empower students (Perumal & Vinothkumar, 2022). It is considered to be a collaborative way of learning where communication is multi-directional based on the principle that knowledge is socially constructed.

One of the most important educational outcomes and most important key skillconsidered under twenty-first-century skills is collaboration (Griffin, McGaw, & Care, 2012; OECD PISA Collaborative Problem-Solving Expert Working Group, 2013). The P21 Framework for 21st Century Learning (2010) includes "collaboration as one of its four key concepts (the Four Cs), along with creativity, critical thinking, and communication". Collaboration is a process in which entities share information, resources and responsibilities to jointly plan, implement, and evaluate a program of activities to achieve a common goal. "Collaboration requires a "collaboration space," that is, an environment to enable and facilitate the collaboration process. The characteristics and nature of this "space" depend on the form of collaboration. Collaboration can take place at the same time (synchronous collaboration) or at different times (asynchronous collaboration). It may also occur in the same place (collocated collaboration) or in different places (remote or virtual collaboration)" (Winkler, 2002). Web 2.0 tools allow the learners to proceed anytime any place basis.

In recent years, researchers have integrated various technologies and tried to develop pedagogical framework to further learning outcomes. The studies reveal that collaboration skills can be enhanced by using wikis (Reich, 2019; Deng, Sandy & Jie Lu,

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2018; Sharp & Whaley, 2018; Olzan& Yehuda, 2016; Zheng, Niiya&Warschauer, 2015); WhatsApp classroom groups (Rosenberg &Asterhan, 2019; Hertzog & Swart, 2018); social media environments i.e. Facebook, Twitter, Instagram, Blogs and YouTube (Tokmak&Dağlı, 2019; Rodríguez-Paz, González-Mendivil, Zárate-García & Peña-Ortega, 2018; Jang, 2015;) in the online classroom (Valenti, Feldbush & Mandernach, 2019); video lectures (Ha, 2016); implementing social media tools in blended learning model (Lam, 2015; Aghaee, 2010); (MSG-based learning activities (Sánchez & Olivares, 2011), online collaborative learning (Klein & Solem, 2008). Facebook, YouTube, Twitter and WhatsApp are the most used SNS for learning purposes. These are mainly used for collaboration, communication, enhancing learning, sharing information and social connection (Zulkanain, Miskon, Abdullah, Ali & Bahari, 2018). Collaboration in further increases motivation (Rocca, Margottini& Capobianco, 2014; Sánchez & Olivares, 2011) and interest (Klein & Solem, 2008).Collaborative approaches also enhance metacognition among students in such a way that it furthers thinking and reasoning and enables students to give elaborated explanations (Lai, 2011).

Another important aspect that contributes towards learning is students' approach to learning viz. deep and surface. Students may vary not only in their capacities for learning but also in the ways in which they approach the given task. "Deep learners try to understand the real meaning of the concepts. The surface approach is characterized by the student's lack of interest in the subject matter and memorization of exam knowledge and this approach regards learning as an external state" (Byrne, Flood & Willis, 2002). These are strongly related to both students' ideas and conceptions of learning and perceptions of their teaching-learning context, and refer to how students go about learning, to their learning intentions (motives) and their methods (strategies) (Biggs, 2001). Group activities (Marjolein, 2010), problem-based learning (Mok, Dodd & Whitehill, 2009), scaffolding (Mujis, 2007), social activities (Gholson & Craig, 2004) promote deep learning approach. A study by (Kember, Leung and McNaught, 2008) established that approaches to learning are influenced by the teaching-learning environment. Though certain studies have reported negative effect of overuse or dependence of technologies like causing depression and anxiety (Seabrook, Kern & Rickerd, 2016), may cause isolation (Primack et al, 2017) and may cause physical health issues related to eyes and body posture due to prolonged usage of electronic gadgets. For adverse psychological effects, students can be advised to avoid unnecessary social interactions with strangers and focus on the teacher made platform on you tube and wikis. For ill health effects the students can be advised to follow 20-20-20 digital viewing rule as suggested by American Optometric Association (Frye, 2023).The present study is an attempt to study the effect of web 2.0 on the collaboration skills of school students with different learning approaches.

**Objectives**

To study the collaboration skills among the students when taught through web 2.0 technology-based Instructionand conventional method of teaching.

To compare the collaboration skills among students with different learning approaches.

To study the interaction effect between instructional treatments and learning approaches with respect to collaboration skills.

**Hypotheses**

**H1.** There exists no statistically significant difference in adjusted marginal mean of collaboration skills for control and experimental group, whilst controlling for pre-test scores of collaboration skills.

**H2.** There exists no statistically significant difference in adjusted marginal mean of collaboration skills for deep and surface learning approach groups, whilst controlling for pre-test scores of collaboration skills.

**H3.** There is no statistically significant difference in adjusted mean of collaboration skills for control and experimental group with respect to deep and surface learning approach, whilst controlling for pre-test scores of collaboration skills.

The study was delimited in the following aspects:

The study was delimited to Government Model Senior Secondary School, Sector 32-C of U.T. Chandigarh.

The study was delimited to XI Grade Political Science students only.

The experiment was delimited to about 70 days of an academic session.

**Method**

**Design**

Two intact classes were taken and assigned randomly to both the groups and conducted the study using quasi experimental design. It utilizes 2X2 factorial design to study effect of two independent variables i.e. treatment and learning approaches.All the four groups were non–equivalent because intact classes were chosen. Therefore, the non-equivalent comparison group design also known as non-equivalent pre-test and post-test control group design (Creswell, 2013) was employed. In non-equivalent pre-test and post-test control group design pre-tests and post-tests are administered to both control and experimental group, but the treatment is provided to only experimental group. The pre-test of collaboration skills was administered to both the groups. The experimental group was exposed to web 2.0 technology-based instruction and control group was taught through the conventional chalk and talk method of teaching. At the end of the treatment the post-test of collaboration skills was administered to both the groups.

2X2 ANCOVA was employed for analyzing the scores of collaboration skills. The instructional treatments and types of learning approaches were independent variables and collaboration skills was the dependent variable. The variable of instructional treatment was studied at two levels i.e. experimental group ($T_1$) and control group ($T_2$). Learning approach was studied at two levels viz. deep learning approach ($L_1$) and surface learning approach ($L_2$).

**Sample**

The research was carried out on class XI students opting for political science enrolled in CBSE affiliated schools in Chandigarh. Out of total 40 Government Model Senior Secondary Schools of Chandigarh, one school Govt. Model Senior Secondary School, Sector 32-C, Chandigarh was selected using random sampling technique by employing lottery method.In the present investigation, two intact groups of the XI class Political Science students were randomly assigned to the experimental and control group. Further, the students had to be classified on the basis of their learning approaches. So, Revised Two Factor Study Process Questionnaire (R-SPQ-2F) (Biggs et al., 2001) was administered to political science students of both the groupsas per instructions given in the manual. Scoring was done with the help of scoring key. On the basis of the scores obtained by the students for the R-SPQ-2F, the students were classified into two groups of deep learning approach and surface learning approach. Total sample consisted of 141 students (67 in control group and 74 in experimental group).

**Tools**

For the present investigation following tools were used:

1. Instructional material for web 2.0 technology-based instruction (developed by the Investigator)
2. Revised Two Factor Study Process Questionnaire (R-SPQ-2F) (Biggs et al., 2001). The tool was used to assess the students' approach to learning viz. Deep Approach and Surface Approach.
3. Collaboration Skills Assessment Tool (developed by the investigator). The tool comprised of 24 items under six domains viz. shared responsibilities, shared decision making, shared accountability, mutual engagement, mutual trust and mutual respect. The reliability of the tool was found to be high; Cronbach's alpha was found to be 0.84 and the test- retest correlation coefficient was found to be 0.869.

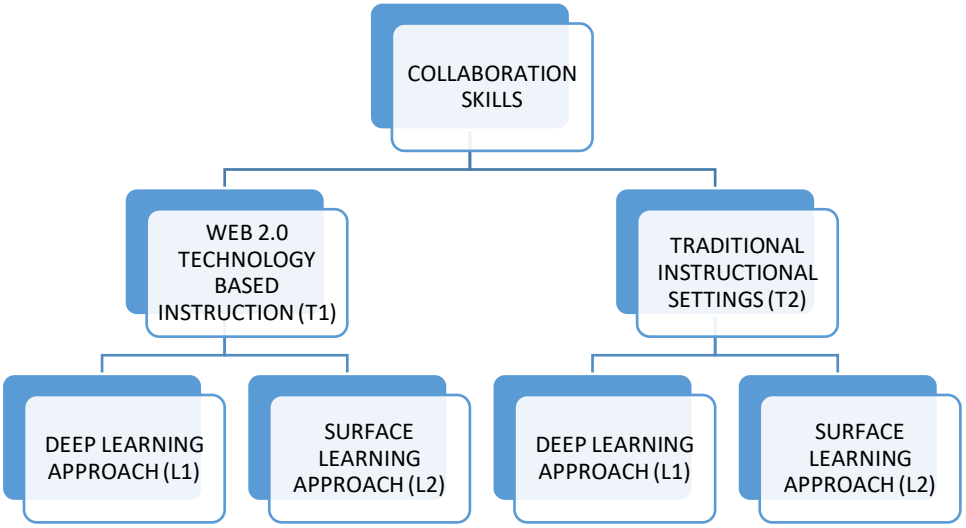


**Fig 1: Schematic layout of design of the study**

**Procedure**

The experiment was conducted in three phases:

**Phase 1: Administration of Pre-test**

In this phase, both experimental and control groups were administered Collaboration Skills Assessment Tool. Scoring was done and pre-test scores were obtained.

**Phase 2: Conducting the instructional program**

In both the groups the same 11 chapters were taught – Local Government, Political theory, Freedom, Equality, Social justice, Rights, Citizenship, Nationalism, Secularism, Peace and Development. The content was selected from the class XI syllabus of political science prescribed by CBSE, New Delhi, published by NCERT, 2007.

A wiki named "Political Science Class" was created on the platform of wikispaces which was used for the collaborative work for the students. Every student had to login with their individual login id created by the teacher.

Youtube was employed to disseminate video lessons to bring the basic maxim of technology 'anytime-anyplace'into effect. A channel named "Social Science Academy" was created on this platform. The video lesson for the chosen content were uploaded on the channel.

WhatsApp was used to build a continuous channel of communication between teacher and students. The links related to the wiki and the you tube videos were shared in the WhatsApp group of the class.

*Process of Collaboration*

The students of the experimental group were divided into 15 groups (14 consisting of five members and 1 group with four members) from both deep and surface learning approach groups.The students used the techniques of brain storming and discussion while working in the groups. After completing the chapter, specific assignment was provided to each group and posted on wiki by the teacher. The students worked on assignment collaboratively by following steps:

- Engagement: The teacher provided the assignment for collaborative activity. After finishing one chapter, the teacher posted one question assignment on the project page of specific group. Instructions for the collaborative and process of writing the answer were mentioned along with the question.
- Exploration: The students worked on the initial generation of ideas and collecting information by going through their books, online sources and mutual discussions.
- Transformation: The group members engaged in activities to "restructure" the information by organizing the content by clarifying and elaborating.

  The communication between group members was facilitated by WhatsApp group and wiki itself. All the students shared their own ideas with each other by posting on the home page of their group. Feedback was provided by the other group members in the comment section and the teacher as well. The initial draft was revised by all the members of the group after going through the feedback. The final answer was posted on the specific group page on Wikispaces.
- Presentation: The group members made the presentation of their assignment in the class. The fellow students were free to ask any number of questions to the group members.
- Reflection: The students analyzed their learning, identified their strengths and weaknesses of the learning processes. The teacher also provided the online feedback to all the groups.

Thus, along with being a collaborative workspace, the wiki also worked as an assessment tool for both students and teachers.

*Instructions for students working in the group*

- Understand the question and Brainstorm for the ideas. Discuss with your group members.
- Welcome all ideas, don't discourage your group members.
- Develop the concept or idea by going through all the points consulting various resources and collecting evidences.
- There will be one group leader in each group.
- Don't hesitate in asking any question in a group and clear your doubts.
- Be cooperative and mutually helpful to accomplish the given learning task.
- Each member of the group is individually accountable and responsible for the performance of his/her group.
- Use 20-20-20 rule of digital viewing (20 minutes screen time, take 20 seconds break to look 20 feet away)
- Use technology for academic purpose only. Don't use it for gossiping especially with unknown people. Engage yourself only in exploring new content related to your topic.
- Every group should follow the deadline of posting the final answer of the assignment on the wiki page created.

*For Control Group*

The control group was also taught same topics through conventional chalk and talk method.

**Phase 3: Administration of the Post-Test**

After the instructional procedure was accomplished, the collaboration skills assessment tool was immediately administered again to both the experimental and control groups to assess the effect**.**Scoring was done and post-test scores were obtained.

**Table 1Descriptive Statistics for Dependent Variable: Collaboration Skills**

| Collaboration | Treatment | | | |
|---|---|---|---|---|
| | Control | | Experiment | |
| | Deep | Surface | Deep | Surface |
| M | 94.55 | 91.62 | 100.86 | 96.94 |
| (SD) | 9.273 | 8.027 | 6.851 | 7.002 |
| $M_{adj}$ | 95.529[a] | 92.133[a] | 99.039[a] | 100.22[a] |
| (SE) | .818 | .797 | .762 | .801 |

*Note.* a. Covariates appearing in the model are evaluated at the following values: PRE.COLLAB = 90.77.
M = Means, $M_{adj}$ =Adjusted Means, (SD) = Standard Deviations, (SE) = Standard Errors, PRE = Pre-test scores, COLLAB = Collaboration Skills

**Univariate Analysis of Covariance for Collaboration Skills**

Univariate analysis focused on the effectiveness of treatment and the learning approaches using 2×2 analysis of covariance (ANCOVA) for Collaboration Skills.

Table 1 presents the mean (M), standard deviations (SD), **adjusted mean (**$M_{adj}$) and**standard error (SE)**for post test scores of collaboration skills (dependent variable), for each combination of groups of the two independent variables: treatment and learning approaches (i.e. for each cell of the design). "Mean (M) refers to the unadjusted means (not adjusted by the covariate" i.e. pre-test scores of collaboration skills."Whereas, **adjusted mean (**$M_{adj}$) refers to the mean values adjusted by the covariate" i.e. pre-test scores of collaboration skills. "These adjusted means are the predicted group means for the dependent variable when the covariate is set to its average value" (Laerd statistics, 2018) (i.e. the average pre-test scores of collaboration skillsof participants in this study). The footnote of the table 1 mentions that the covariate was set to 90.77, the average value for pre-test scores of collaboration skillsin this study. This table helps in understanding the effect of the covariate on the means of the dependent variable.

**Table 2Summary of ANCOVA**

*Tests of Between-Subjects Effects for Dependent Variable: Collaboration Skills*

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Corrected Model | 7046.656[a] | 4 | 1761.664 | 81.742 | .000 | .706 |
| ntercept | 817.074 | 1 | 817.074 | 37.912 | .000 | .218 |
| 'RE.COLLAB | 5399.231 | 1 | 5399.231 | 250.525 | .000 | .648 |
| 'REATMENT (T) | 1846.836 | 1 | 1846.836 | 85.694 | .000 | .387 |
| .EARNING APPROACHES L) | 5.014 | 1 | 5.014 | .233 | .630 | .002 |
| 'REATMENT * LEARNING APPROACHES (T XL) | 21.746 | 1 | 21.746 | 1.009 | .317 | .007 |
| 'rror | 2931.022 | 136 | 21.552 | | | |
| 'otal | 1313570.387 | 141 | | | | |
| Corrected Total | 9977.678 | 140 | | | | |

*Note.* a. R Squared = .706 (Adjusted R Squared = .698)

The findings from Table 2 showed that the covariate, pre-test scores of collaboration skills, has made statistically significant adjustment $F(1, 136) = 250.525$, $p < .05$, = .000 (.0005) for the association between independent variable i.e.treatment and dependent variable i.e. post-test scores of collaboration skills. It also showed a statistically significant association between covariate i.e. pre-test scores of collaboration skills and dependent variable i.e. post-test scores of collaboration skills.

**Main Effect**

**Treatment (T)**

Table 2 showed statistically significant $F(1, 136) = 85.694$, $p < .05$, = .000 (.0005), partial $\eta^2 = .387$ main effect of treatment on collaboration skills.

There was difference in adjusted marginal mean of collaboration skills for experiment group, exposed to web 2.0 technology-based instruction ($M = 99.632$) compared to control group, exposed to convention method ($M = 92.331$).Bonferroni post hoc test (i.e. pairwise comparisons with a Bonferroni adjustment) revealed that the adjusted marginal mean of collaboration skills for the experiment group was 7.301 higher than the control group. It also showered statistically significant main effect of web 2.0 technology-based instruction on adjusted marginal mean of collaboration skills, $p < .05$ = .000 (i.e. .0005).

The effect size calculated for treatment using partial eta squared ($\eta_p^2$) in table 2 was found to be .387 indicating that total 38.7 % of total variance of collaboration skills is explained by the main effect of treatment.

Thus, an instructional intervention elicited a statistically significant difference in adjusted marginal mean of collaboration skills for those who were exposed to web 2.0 technology-based

instruction ($M$ = 99.632) compared to those who were exposed to convention method ($M$ = 92.331), 7.301 (95% CI, 5.741 to 8.860), $p$< .05, = .000 (i.e. .0005), $\eta_p^2$ = .387. Hence H1 was rejected.

**Learning Approach (L)**

Table 2 showed no statistically significant $F$(1, 136) = .233, $p$< .05, = .630, partial $\eta^2$ = .002 main effect of Learning Approaches on collaboration skills.

There was difference in adjusted marginal mean of learning approaches for deep group ($M$ = 96.179) compared to surface group ($M$ = 95.784).Bonferroni post hoc test (i.e. pairwise comparisons with a Bonferroni adjustment) revealed that the adjusted marginal mean of learning approaches for the deep group was .395 higher than the surface group. It also showered no statistically significant main effect of learning approaches on adjusted marginal mean of learning approaches, $p$> .05 = .630.

The effect size calculated for learning approaches using partial eta squared ($\eta_p^2$) in table 2, was found to be .002 indicating that only 0.2 % of total variance of collaboration skills is explained by the main effect of learning approaches.

Thus, the learning approaches did not elicit a statistically significant difference in adjusted marginal mean collaboration skills for those having deep learning approach ($M$ = 96.179) compared to those having surface learning approach ($M$ = 95.784), .395 (95% CI, -1.225 to 2.015), $p$> .05, = .630, $\eta_p^2$ = .002. Hence H2 was retained.

**Interaction Effect of Treatment and Learning Approach (T X L)**

From table 2, it is found that there was no statistically significant interaction between treatment and learning approaches on collaboration skills, whilst controlling for pre-test scores of collaboration skills, $F$(1, 136) = 1.009, $p$ > .05,= .317, partial $\eta^2$ = .007. This indicates that the scores of collaboration skills were not significantly affected by the interaction of treatment and learning approaches. The effect size calculated using $\eta_p^2$ for interaction of treatment and learning approaches was found to be .007, indicating that only 0.7% of total variance of collaboration skills is explained by the interaction effect of treatment and learning approaches. Hence H3 was retained.

**Discussion of Results**

The web 2.0 technology-based instruction significantly enhanced the collaboration skills of the students. The results are in consonance with the results of following studies. Collaboration skills can be enhanced by using wikis (Reich, 2019; Deng, Sandy & Jie Lu, 2018; Sharp & Whaley, 2018; Ha, 2016; Olzan& Yehuda, 2016; Zheng, Niiya&Warschauer, 2015); WhatsApp classroom groups (Rosenberg &Asterhan 2019; Hertzog & Swart, 2018); videos in the online classroom (Valenti, Feldbush & Mandernach, 2019; Ha, 2016); implementing social media tools in blended learning model (Lam, 2015; Aghaee, 2010); online collaborative learning (Klein & Solem, 2008).

It was also revealed that the effect of treatment was not influenced by the learning approaches of the students and vice versa for improving the collaboration skills of the students. The existing learning approaches of the students had no significant effect on the collaboration skills of the students but the mean scores in Table 1 revealed that the surface group had larger improvement in their collaboration skills mean scores. Therefore, it can be suggested that collaborative approach can prove to be beneficial

Table 3*Estimates for Dependent Variable: Collaboration Skills*

| | | | 95% Confidence Interval | |
|---|---|---|---|---|
| TREATMENT | Mean | Std. Error | Lower Bound | Upper Bound |
| CONTROL | 92.331[a] | .569 | 91.205 | 93.457 |
| EXPERIMENT | 99.632[a] | .542 | 98.560 | 100.703 |

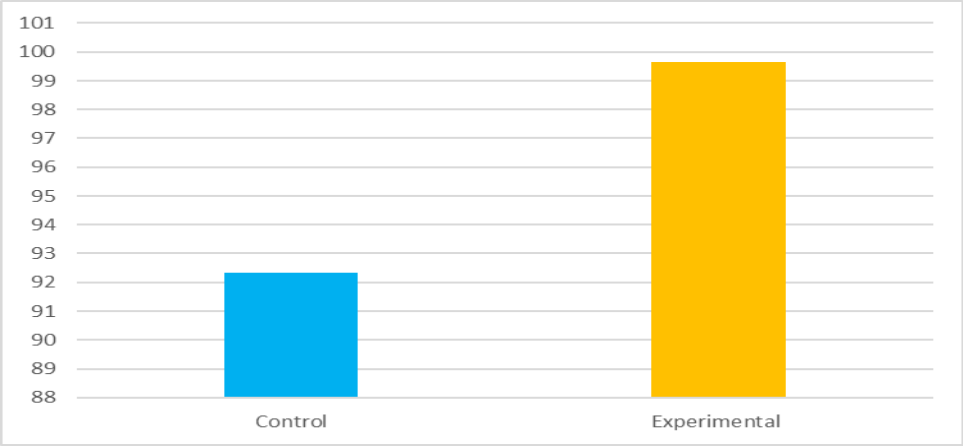


*Figure 2.*Adjusted Marginal Mean for Collaboration Skills for Treatment Groups

especially for the students having surface approach to promote deeper learning.

**Conclusion**

Web 2.0 technologies can be easilyintegrated within the framework of a teacher-controlled model of instruction. Like, teachers can create their own blog related to the content that requires elaborated explanation to an online or offline course by creating "teaching area", or encourage students to chat or work offline then post their work back in the "teaching" area created online for their class. These technologies may be used to deliver a live lecture with slides, or a podcast to getapprised from the experts across the globe, or to transmit a recorded classroom lecture. Web 2.0 tools can be used quite independently of an LMS and can also be made available within an LMS. It can be used in combination with other teaching strategies.

**References**


Aghaee, N. (2010). Social Media Use in Academia: Campus Students Perceptions of How Using Social Media Supports Educational Learning**.** Retrieved from https://uu.diva-portal.org/smash/get/diva2:351931/FULLTEXT01.pdf

Biggs, J. B., Kember, D., & Leung, D. Y. P. (2001). The revised two factor study process questionnaire: R-SPQ-2F. *British Journal of Educational Psychology, 71,* 133-149.

Boulos, M. N., Maramba, I., & Wheeler, S. (2006). Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. *BMC medical education*, *6*(1), 41. doi:10.1186/1472-6920-6-41

Byrne, M., Flood, B., & Willis, P. (2002). The relationship between learning approaches and learning outcomes: a study of Irish accounting students. *Accounting Education*, *11*(1), 27-42. doi: 10.1080/09639280210153254

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). California, CA: Sage publications. Retrieved from https://books.google.co.in/books?isbn=1452226105

Deng, L., Sandy C. L., & Jie Lu (2018) Supporting collaborative group projects with Web 2.0 tools: A holistic approach, Innovations in Education and Teaching International, 55:6, 724-734, DOI: 10.1080/14703297.2017.1321494

Frye, S. N. (2023). Does the 20-20-20 rule prevent the eye strain? https://www.medicalnewstoday.com/articles/321536

Gholson, B., & Craig, S. D. (2006). Promoting constructive activities that support vicarious learning during computer-based instruction. *Educational Psychology Review, 18*(2), 119-139. doi: 10.1007/s10648-006-9006-3

Gilster, P. (1997), Digital literacy. New York: Wiley Computer Publishing.

Griffin, P., McGaw, B., & Care, E. (Eds.). (2012). *Assessment and teaching of 21st century skills*. New York, NY: Springer.

Ha, M. J. (2016). Wikispaces: A Social Constructivist Approach to Flipped Learning in Higher Education Contexts. *International Journal of Contents, 12*(4), 62-68.

Hertzog, P. E., & Swart, A. J. (2018, April). The use of WhatsApp in design-based modules. In *2018 IEEE Global Engineering Education Conference (EDUCON)* (pp. 445-450). IEEE.

Inoue, H., Naito, E., &Koshizuka, M. (1997). Mediacy: what it is? Where to go?.*The International Information & Library Review, 29*(3-4), 403-413. doi: 10.1080/ 10572317. 1997.10762448

Jang, Y. (2015). Convenience matters: A qualitative study on the impact of use of social media and collaboration technologies on learning experience and performance in higher education. *Education for Information, 31*(1, 2), 73-98. doi: 10.3233/EFI-150948

Kember, D., Leung, D. Y., & McNaught, C. (2008). A workshop activity to demonstrate that approaches to learning are influenced by the teaching and learning environment. *Active Learning in Higher Education, 9*(1), 43-56.

Klein, P., & Solem, M. (2008). Evaluating the impact of international collaboration on geography learning. *Journal of Geography in Higher Education, 32*(2), 245-267.doi: 10.1080/03098260701728500

Lam, J. (2015). Collaborative learning using social media tools in a blended learning course. In *Hybrid Learning: Innovation in Educational Practices* (pp. 187-198). Springer International Publishing.

Marjolein (2010). *Influence of Social Strategy on Deep learning.* Retrieved fromwww.slideshare.net/terrya/three-gener.

Mok, C. K., Dodd, B., & Whitehill, T. L. (2009). Speech-language pathology students' approaches to learning in a problem-based learning curriculum. *International journal of speech-language pathology, 11*(6), 472-481.

Mujis, D. (2007). Understanding how pupils learn: Theories of Learning and Intelligence. In V. Brooks, I. Abbott and L. Bills (Ed.), *Preparing to Teach in Secondary Schools.* Maidenhead: Open University Press.

OECD PISA Collaborative Problem Solving Expert Working Group (2013). *PISA 2015 draft collaborative problem solving framework.* Retrieved from http://www.oecd.org/pisa/pisaproducts/Draft%20PISA%202015%20Collaborative%20Problem%20Solving%20Framework%20.pdf

Olzan, G. & Yehuda, P. (2016). Pedagogical aspects of integrating wikis in pre-service teacher education. *Technology,Pedagogy and Education*, 25:4, 469-486, DOI: 10.1080/1475939X.2015.1077884

La Rocca, C., Margottini, M. and Capobianco, R. (2014) Collaborative Learning in Higher Education.

*Open Journal of Social Sciences*, *2*(02), 61-66. doi: 10.4236/jss.2014.22009.

Laerd Statistics (2018). Two-way ANCOVA in SPSS statistics.
https://www.bing.com/ck/a?!&&p=5ce90b5d30908513JmltdHM9MTcwNDY3MjAwMCZpZ3VpZD0yNGM1Mjg1OS1kZWM2LTZiZGEtM2JmOC0yNmExZGY3NDZhYjMmaW5zaWQ9NTMxOQ&ptn=3&ver=2&hsh=3&fclid=24c52859-dec6-6bda-3bf8-26a1df746ab3&psq=laerd+statistics+ancova&u=a1aHR0cHM6Ly9zdGF0aXN0aWNzLmxhZXJkLmNvbS9zcHNzLXR1dG9yaWFscy90d28td2F5LWFub3ZhLXVzaW5nLXNwc3Mtc3RhdGlzdGljcy5waHA&ntb=1

Lai, L. S., & Turban, E. (2008). Groups formation and operations in the web 2.0 environment and social networks. *Group Decision and Negotiation*, *17*(5), 387-402. doi: 10.1007/s10726-008-9113-2

Perumal, R. B. V. & Vinothkumar, K. (2022). The uses of web 2.0 technologies in education. In Devaki, N. &Deivam, M. (eds.). Emerging Trends of ICT in Teaching and Learning pp. 86-95, Insta Publishing, Chhattisgarh.

Primack, B.A., et al. (2017). Social media use and perceived social isolation among young adults in U.S. *American Journal of Preventive Medicine*, 53(1), 1-8. doi: http://doi.org/10.1016/j.amepre.2017.01.010

Reich J. (2019) Just Posting in the Same Place: Confronting the Paucity of Collaborative Behavior in US K-12 Wikis. In: Adesope O., Rud A. (eds) Contemporary Technologies in Education. Palgrave Macmillan, Cham

Richardson, T. (2009). How Web 2.0 has changed the face of education. *IT adviser*, *55*. Retrieved from http://www.ncc.co.uk/article/?articleid=13295

Rodríguez-Paz, M. X., González-Mendivil, J. A., Zárate-García, J. A., & Peña-Ortega, L. O. (2018, November). The Positive Effects on Student Performance of Using Social Networks in Courses of Applied Mechanics. In *ASME 2018 International Mechanical Engineering Congress and Exposition*. American Society of Mechanical Engineers Digital Collection.

Rosenberg, H., &Asterhan, C. S. C. (2019). What's App, sir? Teachers and students in WhatsApp groups (in Hebrew). *Breaking down barriers? Teachers, students and social network sites*.

Roy, P. (2023). The use of web 2.0 tools and technologies in english language teaching-learning process. *Gyan Management Journal,* 17(2), 23-30.

Sánchez, J., & Olivares, R. (2011). Problem solving and collaboration using mobile serious games. *Computers & Education*, *57*(3), 1943-1952. doi: 10.1016/j.compedu.2011.04.0 12

Seabrook, S.M., Kern, M. & Rickard, N.S. (2016). Social networking sites, depression and anxiety: a systematic review. *JMIR Mental Health*, 3(4). doi: 10.2196/mental.5842

Sonmez, E.E. &Cakir, H. (2021). Effect of Web 2.0 Technologies on Academic Performance: A Meta-analysis Study. *International Journal of Technology in Education and Science*, 5(1), 108-127.

Sharp, L. A., & Whaley, B. (2018). Wikis as Online Collaborative Learning Experiences: "A Different Kind of Brainstorming". *Adult Learning*, *29*(3), 83-93. Tokmak, H. S., &Dağlı, Z. Investigation of Math and Psychology Teacher Candidates' opinions about the Social Media Use for Instructional Purposes. *Journal of Advanced Education Studies*, *1*(1), 68-78.

Valenti, E., Feldbush, T., & Mandernach, J. (2019). Comparison of Faculty and Student Perceptions of Videos in the Online Classroom. *Journal of University Teaching & Learning Practice, 16*(3), 6.

Wheeler, S., Kelly, P., & Gale, K. (2005). The Influence of Online Problem-Based Learning on Teachers' Professional Practice and Identity. *ALT-J: Research in Learning Technology*, *13*(2), 125-137. Retrieved from http://files.eric.ed.gov/fulltext/EJ820154.pdf

Winkler, R. (2002). Keywords and Definitions Around" Collaboration. *SAP Design Guild, Edition*, *5*, 12.

Zheng, B., Melissa, N., & Warschauer, M. (2015). Wikis and collaborative learning in higher education. *Technology, Pedagogy and Education*, 24:3, 357-374, DOI: 10.1080/1475939X.2014.948041Zulkanain, N. A., Miskon, S., Abdullah, N. S., Ali, N. M., & Bahari, M. (2018, June). Social Network Sites (SNS) Utilization in Learning Landscape–Systematic Literature Review. In *International Conference of Reliable Information and Communication Technology* (pp. 963-972). Springer, Cham.