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Collective Intelligence in Online Educational Technologies

Amruta P. Chougule[1] and Manisha S. Dabade[2]
[1-2]Assistant Professor, The Sharad Institute of Technology College of Engineering/ Department of Computer Science and Engineering,
Ichalkaranji, Maharashtra, India
Email: chouguleamruta24@sitcoe.org.in,msdabade2017@gmail.com

***Abstract*—The application of Collective Intelligence (CI) conception has produced substantial and important results in a huge knowledge region. Collective Intelligence has significant potential to produce great results and impact in educational technologies. On account of collective intelligence, technologies of Online education, Cognition, Co-operation, Coordination and distance educational technologies, The CI has extensive potential to improve problem solving, collaboration and social learning. This paper presents how Collective Intelligence (CI) has been used in admixture with online educational technologies and it also presents a systematic architecture to determine how CI has been used in online learning environments or domains and identifying the benefits that are encountered in the use process.**

***Index Terms*— collective intelligence, technologies of Online education, Cognition, Co-operation, Coordination.**

I. INTRODUCTION

Collective intelligence (CI) is the procedure in which a sizable group of individuals gathers collectively and share their knowledge, skills and data. It is shared or group intelligence that emerges from the collective efforts, collaboration and competition of many individuals and appears in agreement decision making. CI strongly contributes to the shift of knowledge and power from the individual to the collective. If collective intelligence is used in online educational technologies, it will be more successful and effective than other online educational technologies.

Due to the current pandemic situation online educational technologies have substantial and great demand and online education is a need of the whole world. The COVID-19 has brought about schools shut all across the world. Consequently, education has replaced dramatically, with the distinctive increase of e-learning, according to what teaching is undertaken remotely and on by using digital platforms. Nowadays many online learning programs are offering free access to their services. There are some major weaknesses to E-Learning or online educational technologies. A few of them are discussed here such as developing the communicational skills of the students is an area often neglected during online lessons, online instructors serve to focus on theory rather than practice so students fail to pass in E-Learning.

Their knowledge on others as well as fail to apply their knowledge practically. Classes that mean lectures and practical, tutorials, assignments are held on online learning platforms. Online students can cheat on assessments more easily so we can't say that online education is effective. On variation of age groups effectiveness of online

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learning changes.
Current innovative educational technologies are digital readers, 3d printing, virtual reality, gamification, cloud technology, AI, mobile technology etc. Online educational technologies have revolutionized the way education can be delivered [1] by allowing online courses to be made available to thousands of students around the world. Educational technologies that are on the rise include course management systems (CMSs), such as Moodle; intelligent tutoring systems (ITSs) [2], [3]; computer-supported collaborative learning (CSCL) [4], [5]; and massive open online courses (MOOCs) [6], such as edX, Coursera, and Udacity courses. Some current innovative educational technologies are discussed in table I.

TABLE I. MERITS AND DEMERITS OF CURRENT TECHNOLOGY

Technology	Merits	Demerits
Virtual Reality(VR) Augmented Reality	1. Provides excellent visualizations than a traditional classroom. 2. Creates interest in students. 3. Increases students' engagement. 4. Improvement in quality of education.	1. Decay Human Connections. 2. Not easily modifiable. 3. Issues in functionality. 4. Addiction of Virtual World. 5. Costly.
Artificial Intelligence	1. Immersive Learning. 2. Organized Information. 3. Intelligent Tutoring Systems.	1. No Personal Connection 2. Information may be in Wrong Hands
Pedagogical Technology	1. Improve quality of teaching and student's learning way 2. Understand deep concepts of fundamental material	1. Not allow learners to work together. 2. The lessons will become boring because of listening to one person for a long period.

In online educational technologies, the use of CI will be very much beneficial. CI can improve collaboration, social learning, and the resolution of complex problems. In these technologies, CI presents the possibility of permanent and collaborative learning by guiding students in the knowledge acquisition process [8].
To improve educational aspects by group intelligence CI is advantageous because it enables the exploration of the potential of collaboration and collaborative learning in social environments. It creates more diverse educational contents. Moreover, approximately 74% of the studies presented positive evidence of learning benefits. However, approximately 40% of the studies also presented positive evidence of implementation difficulties.

II. BACKGROUND

The CI was invented by Marquis de Condorcet in 1785. His "jury theorem" introduced the CI concept, in that he states that each member of a voting group individually cannot make the correct decision but a number of members of the group can make the correct decision. That means the probability of the maximum vote of the group increases correctness.
After that in 1962 Douglas Engelbart worked on that he linked CI to organizational effectiveness, and predicted the result as 'augmenting human intellect' which gives a multiplier effect in group problem solving. In 1994, the term 'collective IQ' was used as a measure of collective intelligence, to focus attention on the opportunity to significantly raise collective IQ in business and society.
Collective intelligence is related to engagement in intellectual cooperation of human groups to create, innovate and invent [8], [9] and to perform a wide variety of tasks [10]. CI is enhanced by the use of computational technologies, which enable users to share their ideas with others quickly, easily, and safely [11].
Wikipedia is one of the well known examples of CI. Other examples are multiplayer games, specialized information sites such as Digital Photography Review or Camera Labs, maps, Google's page rank, social sites, Amazon's Recommendation (Amazon which buy or sell the products).

Collective intelligence is widely used in business, industries and organizations e.g., business enterprises, government or military institutions, or local government and civic organizations. Greater access to information and greater direct participation of workers are realities that companies must take advantage of, to transform collective knowledge into economic value, in the sense of achieving better results from the interaction between people and technology, as an intangible resource for organizational and business design. Collective intelligence helps to take the best ideas, perspectives and opinions from members of a team and implement them to create something greater. It only works when everyone works together, and plenty of other businesses are realizing the power of it. When a business has a collective mindset where everyone consorts and shares their innovative ideas, it can go on to make new and big changes to the industry. Whether business is big or small, collective intelligence can help it go a long way.
In the research field also Collective intelligence is used and also it is a quickly expanding field. Research fields have problems like prediction, Collective intelligence gives more accurate results than experts.

III. Materials and Methods

A. Cognition

Cognition is gaining knowledge and understanding. The logical process includes thinking, knowing, remembering, judging, and problem-solving. Thinking is the most important thing in education because only knowing and remembering is not sufficient for well understanding. It is better to gain knowledge. Knowing and remembering part accomplished by lectures of the experts. After that experts judge the understanding level and problem solving capacity of students by questioning. Those questions should be practical based.

B. Cooperation

Cooperation is the process of groups working together on a common task. After cognition next is cooperation, in this phase experts make groups of students based on their ability and assign tasks to students to solve in groups. It enhances the collaboration among students even in online learning technologies. Students interact with each other with interest to discuss their ideas. So automatically student participation will increase. And there is competition between groups for the best solution of tasks given by experts. Individual student skills such as creativity, teamwork, communication, and collaboration are stimulated by cooperation.

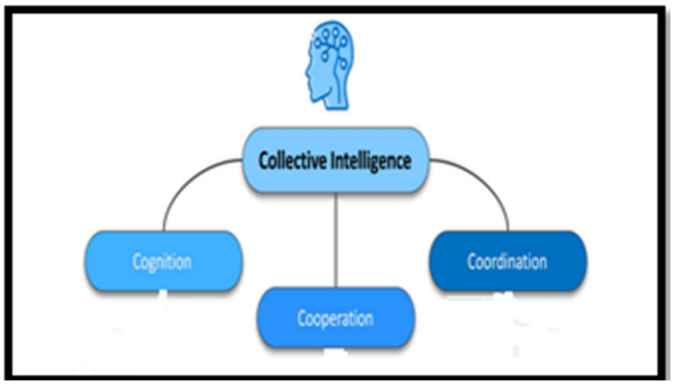

Fig1: Collective Intelligent Steps

C. Coordination

The process to check student's work properly and well by experts. Coordination contains Analysis of student's work quality and student's participation. Students interact themselves and promote new knowledge obtained from their experiences. The experts represent the excellence in the research and development in methodology. Idea management and real time assessment are two strategies achieved by collective intelligence.

IV. Performance Analysis

We have taken experiments on students some days they learnt using traditional online methods and some days they learnt using collective intelligence methods. After that we have taken surveys by using questionnaires. In that respondents are our institute students. The students are from different educational courses like engineering, polytechnic, junior college -science and commerce, Agriculture College, school.

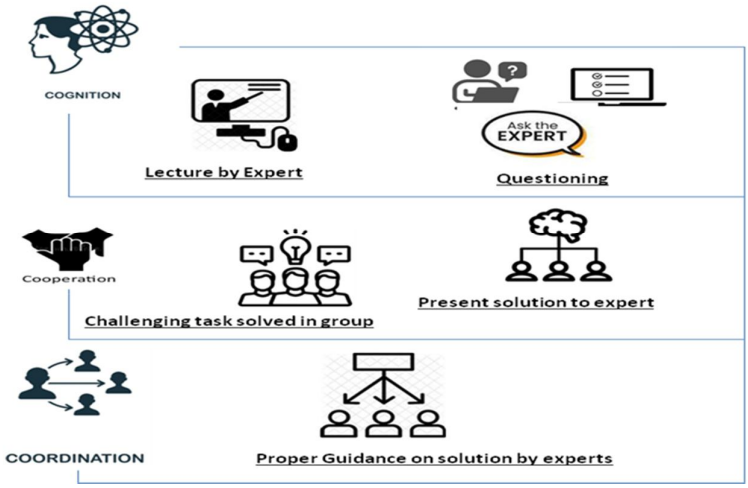

Fig 2: Online Education Methodology

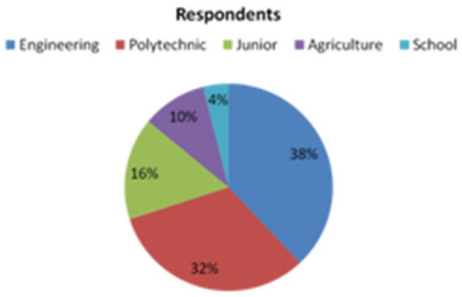

Fig.2 : College wise Respondents

Figure 2 shows the College -wise respondents. About 505 students responded to this survey. 38% of the respondents are from Engineering College, 32% of the respondents are from polytechnic college, 16% of the respondents are from junior college, 10 % of the respondents are from agriculture college and 4% of respondents are from school.

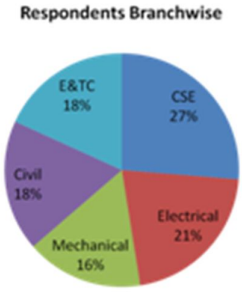

Fig.3: Branch wise Respondents

Figure 3 shows the Branch -wise respondents. About 190 students responded to this survey. 27% of the respondents are from CSE Branch, 21% of the respondents are from Electrical Branch, 16% of the respondents are from Mechanical Branch, 18 % of the respondents are from Civil Branch and 18% of respondents are from E&TC Branch.

1. Which method is effective for online learning?

a) Traditional method b)Collective Intelligence

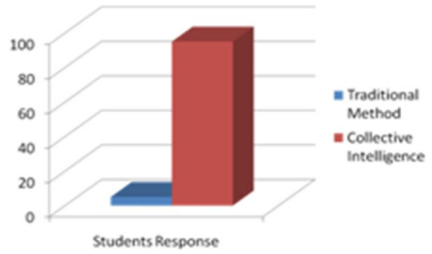

Fig. 5: Effective method

2. Doubts are cleared after studying by collective intelligence method
a) Best b) Average c) Poor

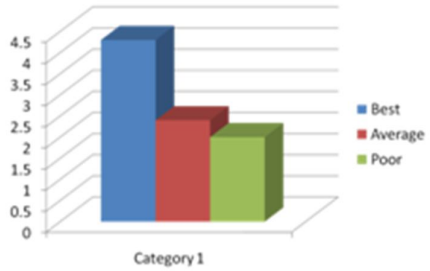

Fig. 6: Doubts clearance

3. Can you explain concepts to others after studying by collective intelligence method?
a) Best b) Average c) Poor

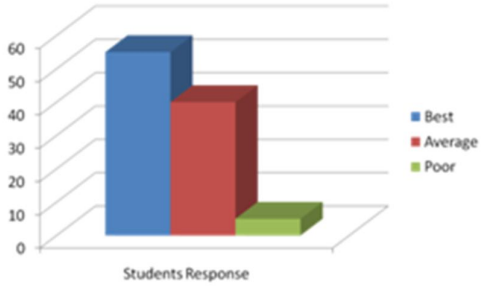

Fig. 7: Explanation capacity

4. Can you apply concepts practically after studying by collective intelligence method?
a) Best b) Average c) Poor

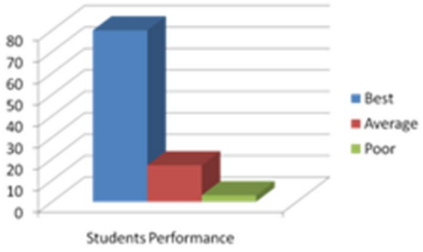

Fig. 8: Practical implementation

5. Does the collective Intelligence approach motivate you to learn?
a) Best b) Average c) Poor

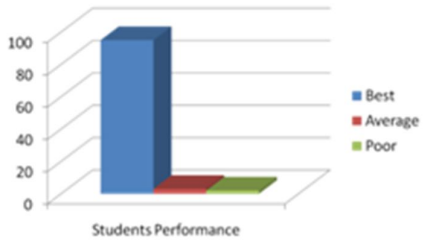

Fig. 9: Motivational Learning

The outcome of the survey is that learning by collective intelligence is better, motivational, practical and challenging than traditional online education technology.

V. Discussion

CI improves collaboration of individuals and participation in online education technology [12] [7] - In current online education technology students are bored by listening to continuous lectures. They felt alone due to less communication and less participation of students. The environment stimulates individual learning so interaction among students is not possible. Collective Intelligence increases interaction among students. In part of cooperation of CI they communicate with each other and evaluate tasks on collective ideas.
CI enhances interest and motivation to learn in online education technology [15] - In current online education technology students need motivational learning. Students are not interested in participating regularly. In CI methodology experts assign challenging tasks in groups so it will be interesting and motivational learning to students.
CI improves knowledge acquisition power of students in online education technology [20] - Due to CI improves student learning because of participation of students. Also student's skills improve like communication, confidence, teamwork, creativity. CI improves the performance of students, students can apply their knowledge to evaluate tasks, and students can explain concepts to others because they studied deeply.

VI. Conclusions

In this paper, we determine how CI is better for online educational technologies and how it use.CI provides effective online educational technologies. We presented the suitable architecture of collective intelligence in online educational technologies. There are some major drawbacks to online education. They will be solved by collective intelligence use in online educational technologies. Students will work in groups so some major drawbacks to E-Learning will be reduced like communication skills will increase, social isolation will be removed. Group activities will promote strong self-motivation and disciplinary skills. Students can pass their knowledge to others as well as can apply their knowledge practically.

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