Comprehensive Report of Webinar "Games for Online Teaching and Learning of Computing Skills" on June 11th 2021 conducted by Commonwealth Educational Media Centre for Asia (CEMCA), New Delhi.

Games for Online Teaching and Learning of Computing Skills

Dr. Sridhar Chimalakonda
Department of Computer Science & Engineering
Indian Institute of Technology, Tirupati, India

ch@iittp.ac.in

Research in Intelligent Software & Human Analytics (RISHA) Lab

Resource Person: Dr. Sridhar Chimalakonda, Assistant Professor, Department of Science & Engineering, Indian Institute of Technology Tirupati, and Lead, *Research in Intelligent Software & Human Analytics (RISHA) Lab*

Motivation

Despite the emergence of multiple technologies to support education, it is still a challenge to make learning interactive and interesting, specifically in the domain of computing education, which is critical for industry jobs today. Games, on the other hand, allow an interactive, creative and entertaining experience, and are specifically suited for the nature of programming concepts and skills. Games have been developed and used to teach various computing skills such as *Java* programming (Greenfoot), algorithmic thinking (Scratch, Alice 3D), parallel scheduling (ParallelAR), debugging (RoboBug, Gidget, G4D), and so on.

Debugging is a fundamental skill in computing curriculum that is often considered hard to learn and teach owing to the effort to detect, analyze, and resolve software bugs/issues. Despite the massive availability of educational resources for debugging, it is a difficult skill to learn for many novice programmers and students due to the passive nature of existing modes of teaching. It is here that the potential of games can be leveraged to foster interactivity and interest towards learning debugging skills in open and online education. This is particularly relevant in the current context where there is a need to promote engaging learning experiences through online and blended delivery systems.

Objectives

The two primary objectives of the webinar were:
- To create awareness on the potential of games for active online learning and teaching with multiple game based learning examples.
- To provide an overview of games for online teaching and learning of computing skills and in detail about debugging skill

Webinar topics
Computing Education, Game Based Learning, Games for Computing, Debugging Games

Methodology
The webinar was conducted through online mode using the Zoom video conferencing platform. Dr. Sridhar Chimalakonda presented the webinar, allowed interactions in between and there was a demonstration of the G4D debugging game towards the

end of the session. The session was interactive with many questions and comments from the participants.

WEBINAR ON
GAMES FOR ONLINE TEACHING AND LEARNING OF COMPUTING SKILLS
11 JUNE 2021 (3 PM TO 5 PM)

THIS WORKSHOP IS FOR
- College/ university faculty
- Students
- Researchers
- Online learners and educators

WEBINAR FOCUS
- Computing Education
- Game Based Learning
- Online Games for Computing
- Games for Teaching and Learning Debugging

DR. SRIDHAR CHIMALAKONDA
Department of Computer Science & Engineering
IIT Tirupati

Click _here_ to register

Organised by
Commonwealth Educational Media Centre for Asia (CEMCA), New Delhi

Programme Details (Date and Duration)

The webinar was held on 11th June 2021. The live session was conducted from 3 pm to 5 pm IST through videoconferencing. In addition to the real-time session, participants asked questions during the session and were encouraged to provide comments and queries in the asynchronous mode. The invitation of the program was sent to CEMCA partners and ACM iSIGCSE (Indian wing of Special Interest Group on Computing Education).

Participants

The webinar was attended by 40 participants from open and formal universities across India. Participants were from different disciplines such as education, computer science, games, physics and primarily faculty members with some students. The list of participants is included in the Appendix.

Inaugural session

Prof. Madhu Parhar, Director, CEMCA welcomed all the participants and made her opening remarks with interesting comments on game-based learning. Specifically, she emphasized the need to look for innovative ways of online teaching and hoped that game-based learning could be an interesting direction. She also mentioned that CEMCA is keen to explore the new area of Game-based Learning in Open and Online Education. Dr. Shiffon Chatterjee, Senior Program Officer (Online & Blended Learning), CEMCA has been instrumental in organizing, coordinating and supporting the entire programme.

The Webinar Session

The session by Dr. Sridhar Chimalakonda started off with the below goals for the webinar and it consisted of four aspects, which he explained as different sections of the webinar:

- Game Based Learning
- Computing Education
- Games for Computing
- Games for Debugging
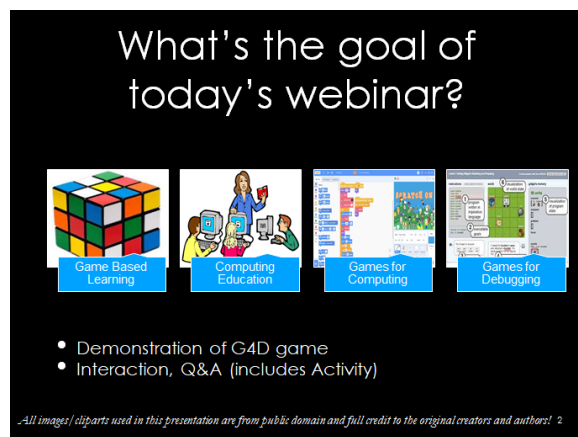
This was followed by highlighting the pros and cons of online teaching and learning, and setting the base for the rest of the webinar by motivating the need for Game-Based Learning (GBL).

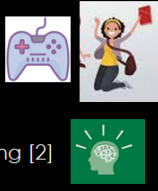| Pros	Cons
- Access to Quality Content – YouTube, MOOCs, OERs - Flexible and Accessible - Asynchronous Communication - Learner Styles	- Lack of motivation! - Attention rates - Minimal interactivity - Distraction - Assessment Challenges - Technical issues!

The speaker introduced the core concepts of GBL and highlighted two key aspects during the design of games from a learning perspective and also clarified the difference between games and gamification, serious and professional games.

Dr. Sridhar further explained the role of learning theories during the design of games for learning, specifically cognitive load theory and scaffolding, and how they could form the base for design of games.

In the next part of the webinar, several Game-Based Examples from multiple domains such as Healthcare, History, Medical, Language Learning were elaborated.

SurviveCovid-19++: A collaborative game!

- Multiplayer game
- Players can take up any of the four avatars
- Multiple virus strains, administering and collecting vaccines and medicines, sanitation works, crowd-breaking

Game designed based on design-guidelines for collaborative games.

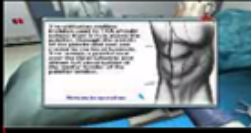Link to research paper preprint:

Youtube video :

Funded by Richard Lounsbery Foundation, USA

CHOOSE AN AVATAR

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Game Based Learning in Medical Field

A Serious Game for Total Knee Arthroplasty [7]

To train orthopedic surgery residents

Series of steps for knee replacement

[7] Cowan, B., Sabri, H., Kapralos, B., Porte, M., Backstein, D., Cristancho, S., & Dubrowski, A. (2010). A serious game for total knee arthroplasty procedure, education and training. Journal of CyberTherapy & Rehabilitation (JCR), 3(3).

L2 - A Mini Game for Learning Indian Language Vocabulary

[8] Agrahari, V., & Chimalakonda, S. (2020, July). L 2-A Mini Game for Learning Indian Language Vocabulary. In 2020 IEEE 20th International Conference on Advanced Learning Technologies (ICALT) (pp. 233-235). IEEE.

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Participants (42)

Find a participant

- CEMCAZoom@col.org (Host, me)
- Sridhar Chimalakonda (Co-host, guest)
- AARTI KASHYAP (Guest)
- Akhila Sri Manasa Venigalla (Guest)
- Anay Kamat (Guest)
- Arpita Sharma (Guest)
- Arun Gautam (Guest)
- CHIRANJIT DAS (Guest)
- CHITRA BABU (Guest)
- Dharitri Devi (Guest)
- Dhiraj Matondkar (Guest)
- Dhirendra Tiwari (Guest)
- Diksha Jain (Guest)
- Dr.Pooran Thiyagarajan (Guest)

Invite   Mute All

Computing Education

The next part of the session was on Computing Education providing multiple examples of how games are used in computing education.

Why learn computing?

Critical Thinking   Problem Solving
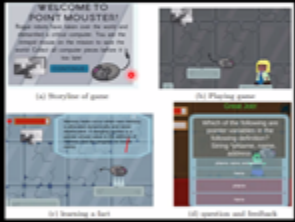
Example of a serious game for memory leaks (left) and discussion from audience (right)

Dr. Sridhar further discussed platforms like *Scratch* and *Alice*, which are primarily used for teaching programming in an interesting way, and incorporate some gamification elements.
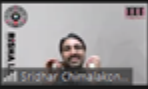
The next part of the session focused on debugging, a critical concept in computing and how games can be used to teach debugging.
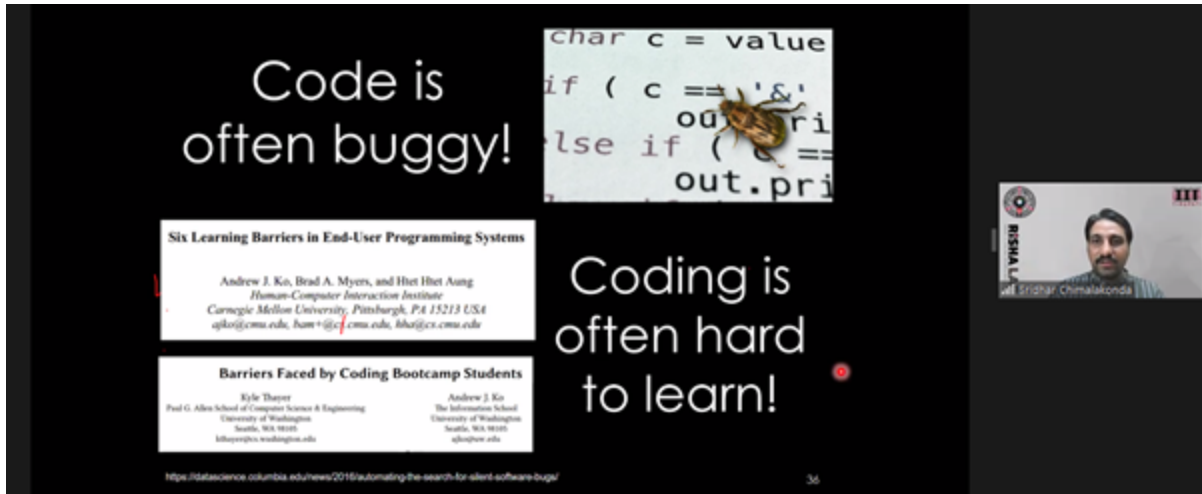
After this, a game called G4D[1] from Dr. Sridhar's lab was explained in terms of how it relies on learning theories as well as game design principles, and a proposal for an extended collaborative game called G4D++
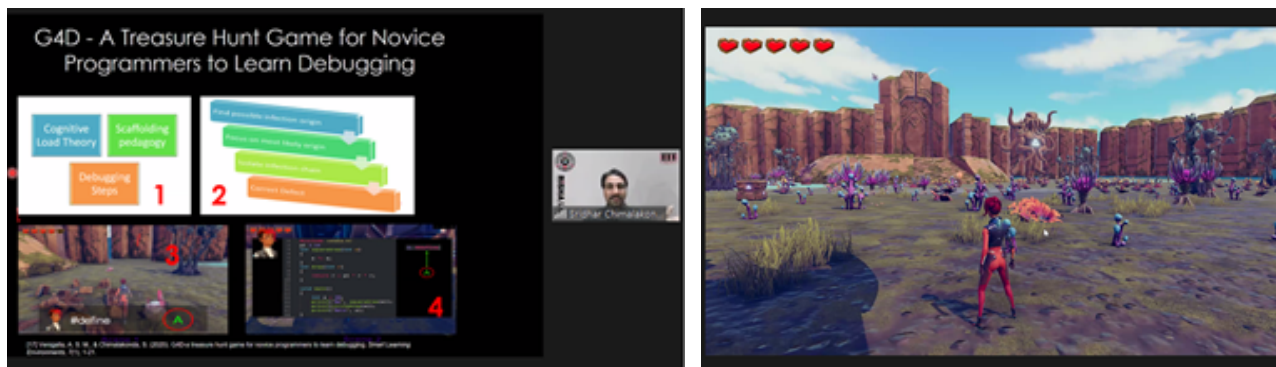
Demonstration of G4D Game

This was followed by a demo on G4D by Akhila Sri Manasa, a PhD scholar from RISHA Lab connecting debugging concepts to game elements.

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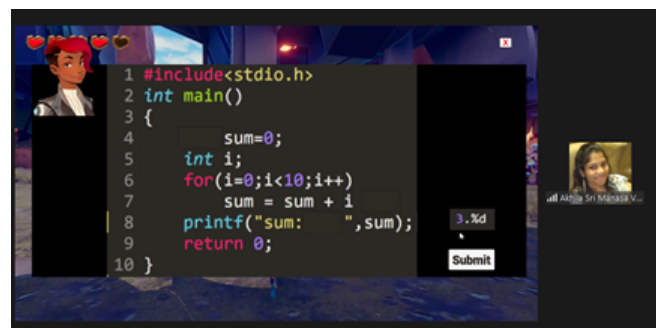
[1] A brief video demo of the game is available at https://youtu.be/rrd2973l-TA
Venigalla, A. S. M., & Chimalakonda, S. (2020). G4D-a treasure hunt game for novice programmers to learn debugging. *Smart Learning Environments*, 7(1), 1-21.

Finally, Dr. Sridhar summarized the key take-aways of the webinar and left two questions for the audience to think in terms of next steps:
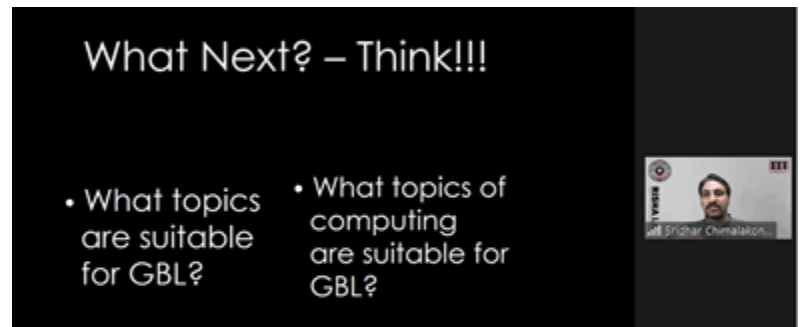
- **Feedback Analysis**

(i) Discussion (During the session)

The speaker encouraged questions and comments at regular intervals as well as through chat during the session, and the webinar had several interesting comments and questions.

Some Q&A/comments during the session:

- Reema Thareja: "Thank you for this very informative and interesting session. I am a CS Faculty teaching in University of Delhi. Please tell me how to let our students know about our gaming app especially in the pandemic times?"
- Vaiyapuri Murugan: "Sir, game based learning is suitable for all age groups ?"
- Ruchitha Kuthethoor: "Sir, is there any way to make games like this more scalable so they can be used for multiple different topics?"
- Vinu Varghese : "Which game engine have you used for the development.?"

Some appreciation towards the end of the talk:
Arpita Sharma : "Thanks a lot for a very interesting talk."
Vinu Varghese : "Thank you for your wonderful session"
Meenambigai R: "Thank you for the great session"

(ii) Google Feedback Form

A google form was circulated to get feedback from all participants, and we had 28 responses. We have included a few key questions and responses here:

How would you rate the webinar?
28 responses

Programme content (Please click your response to the items)
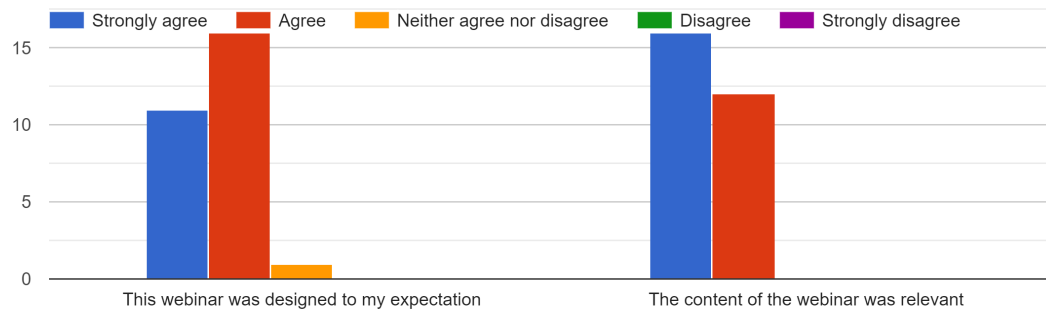
Programme Design (Please click your response to the items)
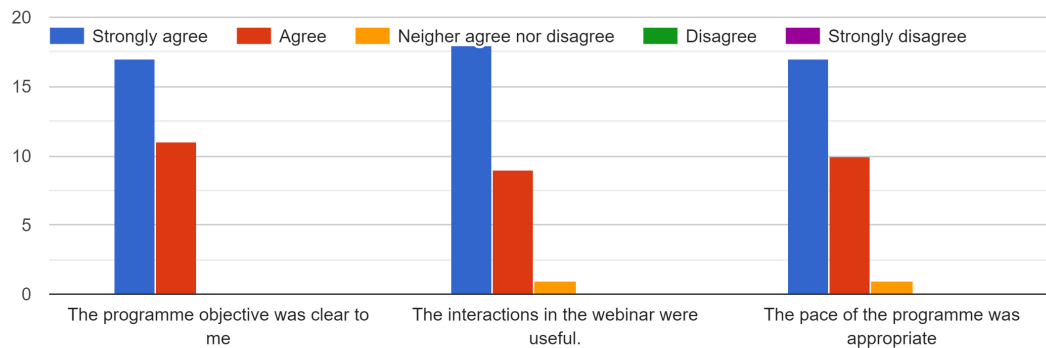
Programme Results (Please click your response to each item)

Legend: Strongly agree ■ Agree ■ Neither agree nor disagree ■ Disagree ■ Strongly disagree ■

Categories:
- I accomplished the objective of this programme.
- I will be able to use what I learned in this programme.
- The programme was a good way for me to learn this content.
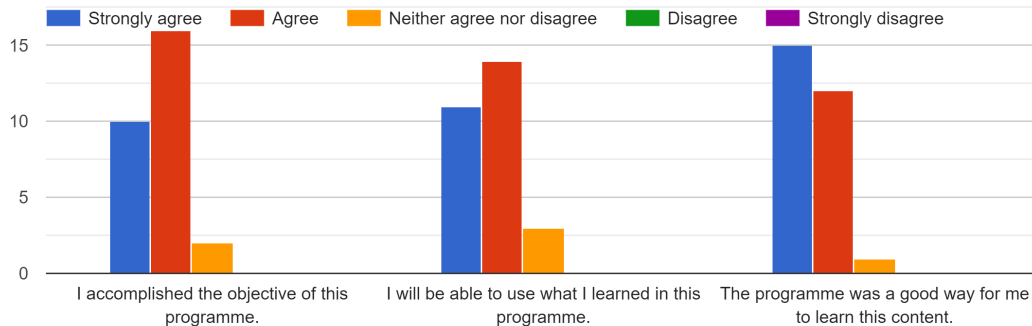
Q. What was the best part of the webinar

"Gaming perspective, All, Gaming aspects towards learning, Demonstrations, The innovative idea, role based activity, Content delivery, The way how games can be implemented in the form of studies, Helping students to learn subjects using games. This way th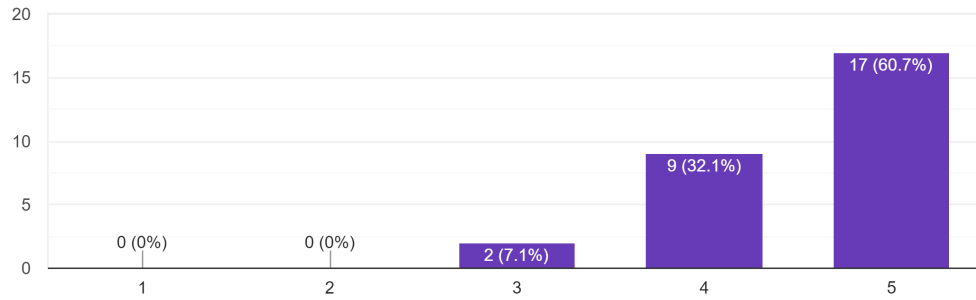ey will learn the concepts and even enjoy and not get bored., It is useful for my profession, delivery of content, Great Presentation, Knowing different applications of gaming in different fields, The Spaceship game was the best part in my opinion being from Physics background. I immediately thought about designing such a game related to Maxwell's equations., GBL and its relevance, Delivery of presentation, Information about how gamification can be used for enhancing learning, Application for gaming, Game based learning, Background of Game Based Learning was established in a good way. Examples were good."

Q. Which aspect of the webinar can be enhanced further?

"More examples, NA, Some development demonstration, It was to the point and not dragged that was the best thing, It will be continued, all was good, Maybe FDP"

Q. The most important / significant ideas that I have learnt while attending this webinar are:

"Teaching boring subject with game, Gaming can be included while teaching for making learning fun for students, Programming Game, Make study more interesting, Game based learning is useful, Adapt to teaching learning dynamics, Another teaching learning style, Teaching through Gamification, Games can be created for

different applications, Involving students through games, Full Fledged interactive 3d games can be used for teaching debugging, Learning with play, Debugging with the help of gamification, tools, In covid game based learning is very important, All, New learning and Teaching trends, Difference between Serious Game design and Gamification. Pedagogies used in GBL etc, How gaming can be used for learning and students can be motivated in online learning."

Q. Do you think that more such programmes/courses/learning resources in this topic would be useful?
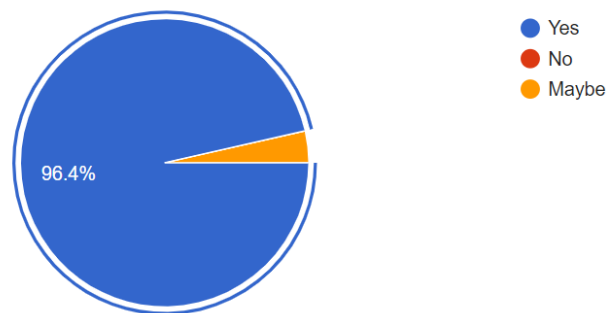
28 responses

Q. As a result of these ideas, I intend to do the following things in future:

"Include this in my classes, Include games in teaching, Try to create some game based learning modules with my students, create basic games for our students to start with and slowly and steadily explain to the students how to implement the same, try to use these in future development, Will try to build a basic game for my students, Will try to develop a small game for teaching, Will be looking for learning and developing games for different areas in Physics in the curriculum, use serious 3d games in my research, I intend to create a gaming methodology for teaching learning, Would like to develop a game for teaching, I will use gamification for my lectures, I shall try to use gaming for fun learning experience. "

Q. Please share any further feedback about the webinar. Thank you.

"Come with another interesting topic, It was very well conducted and perfectly timed. Thank you to the team, Great opportunity to gain insight about Gamification and GBL, Thanks for introducing a very innovative way of teaching learning, It was a great interaction with all of you and thanks to the organizing body. I will be looking for further

such webinars, I am doing my PhD in Computational Thinking and serious games. if there is an opportunity to collaborate, it would be great, Excellent.

CEMCA is always known for high quality relevant content discussion. The selection of topic was praiseworthy as it is highly valuable in the present day context. Moreover the webinar was excellent."

Next steps

It was clear from the interactions during the webinar as well as from the feedback that Game-Based Learning and specifically in the context of computing and debugging is a well perceived topic that has a great deal of interest, more so in the context of online teaching and learning. We will try to develop novel games in collaboration with CEMCA in this area, and try to conduct further events on this topic in the future.

Acknowledgements

We would like to thank Prof. Madhu Parhar, Director of CEMCA for encouraging us for the webinar and her presence and interesting comments during the webinar. We would also like to thank Dr. Shiffon Chatterjee, Senior Program Officer (Online & Blended Learning) CEMCA who was instrumental in organizing the webinar, and her continuous support from the inception of the idea to its execution. We would also like to thank Dr. Venkataraman Balaji of COL for connecting us to Prof. Parhar and his interest in Game-Based Learning for Computing. Most importantly, we would like to thank all the participants who made the webinar quite interactive with their questions and comments. Special thanks to my PhD student Akhila Sri Manasa for doing a demo of the G4D game.

Appendix - List of participants

	Name	Designation	Department	Institution
1	Aarti Kashyap	PG Student	Physics	C.M.D PG College Bilaspur (C.G.)
2	Anay Kamat	Mobile Practice Lead	Software Consulting	Equal Experts
3	Arpita Sharma	Associate Professor	Computer Science	DDU College, Delhi Univetsity
4	Avinash Singh	PG Student	M.Sc.(Physics)	C.M.D PG College Bilaspur (C.G.)
5	Bapukan Saikia	Assistant Professor	Political Science	Jawaharlal Nehru College, Boko
6	Chiranjit Das	Assistant Professor	Physics	C.M.D PG College Bilaspur (C.G.)
7	Chitra Babu	Professor and Head	Computer Science and Engineering	SSN College of Engineering
8	Dharitri Devi	PG Student	Education	Birjhora Kanya Mahavidyalaya,Bongaigaon
9	Dhiraj Matondkar	Teacher	Education Department of Goa	Dnyanprakash Mandal Bicholim Higher Secondary School
10	Dhirendra tiwari	PG Student	M.Sc.(Physics)	Bilaspur university
11	Diksha Jain	Assistant Professor	Computer Science	Indraprastha College for Women, University of Delhi
12	Dr. Kshama Tripathi	A.P.	Education	IASE Bilaspur
13	Dr. Renu Nayar	Assistant professor	Department of Chemistry	D P Vipra College Bilaspur Chhattisgarh

14	Dr. Vinita Jindal	Associate professor	Computer science	Keshav Mahavidyalaya, University of Delhi
15	Dr. Gawande Sunil Laxman	Academic coordinator	Humanities and social sciences	YCMOU, Nashik
16	Dr. Mintu Bhattacharya	Assistant Professor	DS	GU
17	Dr.M.Vaiyapuri	Assistant Professor	School of Tamil and Cultural Studies	Tamilnadu Open University
18	Hunny Gaur	Assistant Professor	Computer Science	St. Stephen's College
19	Manish Kumar Jaiswal	PG Student	M.Sc.(Physics)	C.M.D PG College Bilaspur (C.G.)
20	Maya Anay Kamat	Computer Teacher	School	The Progress High school, Panjim
21	Meenambigai R	Assistant Professor	Continuing Education	Tamil Nadu Open University
22	Neelima Gupta	Professor	Computer Science	University of Delhi
23	Poornima S	Associate professor	IT	SSN CE
24	Prof.P.Thiyagarajan	Director	Continuing Education	Tamil Nadu Open University, Chennai
25	Rachna Sethi	Assistent Professor	Computer Science	Sri Guru Gobind Singh College of Commerce
26	Reema Thareja	Assistant Professor	Computer Science	Delhi University
27	Ruchitha Kuthethoor	Student	Computer Science	PES University

			Engineering	
28	Rupali Ahuja	Assistant Professor	Computer science	Maitreyi college, University of Delhi
29	Saania Sayed	Computer Teacher	Education	Al Madina High School Goa
30	Saieesh Gandhi	Officer	Dept of Agriculture	Agriculture, Goa
31	Seema Aggarwal	Associate professor	Computer science	Miranda House
32	Shabana K M	PhD research scholar	CSE	IIT Palakkad
33	Shikha Verma	Assistant Professor	Computer science	Ram Lal anand College
34	Siddharaj Mopkar	Teacher	Mathematics	Vidyavriksh
35	Sudheer Dubey	PG Student	M.Sc.(Physics)	C.M.D PG College Bilaspur (C.G.)
36	Sudhir Kumar Gupta	Assistant Professor	Computer Science	Keshav Mahavidyalaya, University of Delhi
37	Surojit Acharjee	Asstt. Teacher	Education Department, Assam	Niranjan Paul Institute
38	Tanu Rajput	PG Student	Physics	C.M.D PG College Bilaspur (C.G.)
39	Vinit Nayar	Assistant Professor	Department of Physics	C.M.D PG College Bilaspur (C.G.)
40	Vinu Varghese	Asst Professor	Vocational Education (DDUKK)	Cochin University of Science and Technology