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Appendix A

Questionnaire for Students

1. Schedule No: ________________

2. Name: ______________________

3. Class: ________________

4. Place: ______________________

5. School: ______________________

6.1 Type of School: ☐ Government ☐ Private

6.2 ☐ Secondary ☐ Higher secondary ☐ Both

7. Syllabus: ☐ SSC ☐ CBSE ☐ ICSE

8. Number of Students in the class: __________

9. Gender: ☐ Boy ☐ Girl

10. Learning environment in which students enjoy learning and learn with understanding should be:

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivating</td>
<td></td>
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<tr>
<td>Interactive</td>
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<tr>
<td>Learner-centric</td>
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</tr>
<tr>
<td>Collaborative</td>
<td></td>
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</tr>
</tbody>
</table>

11. Benefits of sharing Simple, Motivating, Interactive, Learner-centric environment

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>We enjoy learning if it is made simple and easy to understand</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Teaching with the aid of multimedia presentations makes learning interesting and engaging</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Interactive simulations improve understanding of difficult concepts and stimulates creative thinking</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Students should have the flexibility to learn anytime, anywhere at his own pace, to suit his learning preferences</td>
<td></td>
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</tr>
</tbody>
</table>
Learning to learn through search engines such as Google, Wikipedia and educational portals such as BBC is sharing knowledge with friends while doing projects on internet, which provides more learning opportunities is their preferred learning style is.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Very important</th>
<th>Important</th>
<th>Can't say</th>
<th>Not important</th>
<th>Not at all important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explaining the concepts with simple, interesting facts relevant to the world around us is</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online quizzes with worked out examples and solutions to improve confidence and satisfaction are</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Interactivity in e-Learning facilitates learning by doing, which is</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Online learning, which helps in learning to learn through search engines such as Google, Wikipedia and educational portals such as BBC is</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sharing knowledge with friends while doing projects on internet, which provides more learning opportunities is</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Highly Useful</th>
<th>Useful</th>
<th>Can't say</th>
<th>Not Useful</th>
<th>Not at all Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explaining the concepts through visual presentations to make learning simple and easy is</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Multimedia presentations, which make learning interesting and motivating are</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactive applets and animations to explain difficult concepts are</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Online learning, which offers flexibility to students to learn how to learn with their preferred learning style is</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Educational portals with open access, which extends learning opportunities to all are</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
14. Key elements: Content, Access, Technology and Collaboration

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to accredited, enriching content is important to enjoy learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broadband access to internet is essential for more ways of learning</td>
<td></td>
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</tr>
<tr>
<td>Technology can make learning more joyful, interactive and collaborative.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Chat, discussion forums helps in learning together and sharing of knowledge</td>
<td></td>
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</tbody>
</table>

15.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher plays a very important role in making learning a joyful experience.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portals with open access are extremely valuable to both students and teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networking of schools to share content and experience of teachers is important</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students can have more flexibility in learning if classroom learning is combined with online learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training for familiarity with computers, internet and other tools like Google and Wikipedia is important for improved learning.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

16. My teacher:  ✓ whichever is applicable

- Presents the material in an interesting way
- Emphasized thinking rather than memorizing
- Gave explanations that were clear
- Helped me to improve my learning skills
- Provides me with useful feedback
- All
17. What subjects do you like to work out on computers?

☐ Maths  ☐ Physics  ☐ Chemistry  ☐ Biology  ☐ Others ______

18. What do you like about your school?

19. What do you wish was different at your school?

20. What do you wish we would have asked you about your education?

21. What kind of learning is interesting?

22. What do you want to become?
Appendix B

Questionnaire for the Teachers

1. Schedule No: __________

2. Name: __________________________

3. School: ________________________

4. Place: _________________________

5. Years of Experience: __________

6. Subject you teach: ______________

7. Educational background: __________

8.1 Type of School: □ Government □ Private
8.2 □ Secondary □ Higher secondary □ Both

9. Syllabus: □ SSC □ CBSE □ ICSE

10. Total Number of Students in the School: __________

11. Number of Students per class: __________

12. Please ✓ Whichever is applicable

<table>
<thead>
<tr>
<th></th>
<th>Enjoy Learning</th>
<th>Learn to learn</th>
<th>Learning flexibility</th>
<th>Learning by doing</th>
<th>Learning together</th>
<th>Learning opportunities for all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivating</td>
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<tr>
<td>Interactive</td>
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<tr>
<td>Learner-centric</td>
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<tr>
<td>Collaboration</td>
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</tr>
</tbody>
</table>
13. Learning environment in which students enjoy learning and learn with understanding should be:

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td></td>
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<td></td>
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<tr>
<td>Motivating</td>
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<tr>
<td>Interactive</td>
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<tr>
<td>Learner-centric</td>
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<tr>
<td>Collaborative</td>
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</tr>
</tbody>
</table>

14. Benefits of sharing Simple, Motivating, Interactive Learner-centric environment

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students enjoy learning if teacher explains the subject matter through</td>
<td></td>
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</tr>
<tr>
<td>simple concepts and interesting facts related to social context of the</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>learner</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Teaching with the aid of multimedia presentations makes learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>interesting and engaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactive simulations help students to develop curiosity and critical</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exploring the subject through educational portals and other online</td>
<td></td>
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</tr>
<tr>
<td>sources such as Wikipedia for doing projects facilitates learning to</td>
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<tr>
<td>learn in students</td>
<td></td>
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</tr>
<tr>
<td>Shared resources including online libraries and educational portals help</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>teachers to be more innovative</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

15. Opinion

| Content structuring and sequencing to move from simple to increased     | Very important | Important | Can't say | Not important | Not at all important |
| levels of complexity is                                               |               |           |           |               |                      |
| Images and pictures centered around a theme along with animations to   |               |           |           |               |                      |
| explain concepts are                                                  |               |           |           |               |                      |
| Simulations of experiments difficult to perform in lab such as total   |               |           |           |               |                      |
| internal reflection are                                                |               |           |           |               |                      |
| Flexibility in learning through access to varied but accredited        |               |           |           |               |                      |
| content from open source such as BBC is                               |               |           |           |               |                      |
| Collaboration among schools in sharing best practices in teaching      |               |           |           |               |                      |
| and content is                                                        |               |           |           |               |                      |
16. **Opinion**

<table>
<thead>
<tr>
<th>Highly Useful</th>
<th>Useful</th>
<th>Can't say</th>
<th>Not Useful</th>
<th>Not at all Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students enjoy learning with a simple, easy to understand images, graphics, animations and simulations are</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Games that simulate applications in real life, which make learning interesting while being relevant and meaningful are</td>
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<tr>
<td>Interactive simulations to explain concepts like Interference and Polarization are</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Quizzes along with worked out solutions that enable learners to assess their own understanding are</td>
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</tr>
<tr>
<td>Virtual classrooms, which extend the reach of expert teachers and facilitates learning for wider audience are</td>
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</tr>
</tbody>
</table>

17. **Key elements: Content, Access, Technology and Collaboration**

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media rich, accredited content such as simulations and animations helps teachers to be innovative and creative.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programs such as EDUSAT, which provide video lectures of expert teachers are highly useful.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Technology provides tools to enhance classroom experience and share knowledge.</td>
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</tr>
<tr>
<td>Collaboration helps in sharing best practices and innovate ways of teaching</td>
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<td></td>
</tr>
</tbody>
</table>

18. **Opinion**

<table>
<thead>
<tr>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher will be at the heart of transformation in learning to facilitate every student to enjoy learning and achieve his/her full potential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational portals with accredited and relevant content such as BBC and WonderWhizKids are highly useful.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networking of schools to collaborate and share the learning modules and best practices of other schools is important.</td>
<td></td>
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</tr>
<tr>
<td>Flexibility in curriculum and assessment facilitates teachers to be more creative in meeting diverse learners needs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training for familiarity with computers, internet and other software tools is important for innovation in teaching.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
19. Your opinion on e-Learning?

☐ makes students more receptive to learning (engagement)
☐ improves students' outputs or performance (output)
☐ improves students' learning (cognition)
☐ enables students to take more responsibility for their own learning (Learn how to learn)
☐ contributes to the management of learning by both tutors and students

20. Satellite based broadcasts of video lectures by experts extends learning opportunities to more students

☐ Strongly Agree
☐ Agree
☐ Somewhat Agree
☐ Disagree
☐ Strongly Disagree

21. Broadband access to internet is essential for the success of e-Learning

☐ Strongly Agree
☐ Agree
☐ Somewhat Agree
☐ Disagree
☐ Strongly Disagree

22. Do you think technology helps you to be innovative and creative?

23. Does technology help you to enjoy teaching?

24. What are your suggestions to improve the educational system?
Appendix C

Questionnaire to Principal / Head Teacher

1. Name: ____________________________

2. School: ____________________________

3. Place: ____________________________

4. Years of Experience: ______________

5. Educational background: ______________

6. Designation ____________________________

7. Type of School: □ Government     □ Private
                   □ Secondary    □ Higher secondary    □ Both

8. Syllabus: □ SSC    □ CBSE    □ ICSE

9. Total Number of Students in the School: ___________

10. Number of Students per class: ___________

11. Do you think e-learning improves the quality of education in schools?
    □ Yes
    □ No

12. Do you have any plans to introduce e-learning?
    □ Yes
    □ No

13. If yes, do you have any formal/informal e-learning strategy?
    □ Yes
    □ No
14. Please share your vision, core values, objectives of your school and your approach to realize the vision?

15. Please mention important attributes of an effective learning environment?

16. How your school is different from other schools in imparting quality education?

17. Please describe the areas for improvement in the present environment, and your suggestions for improving quality of education?

18. Please describe computing and networking facilities available in your school?

19. Please comment on tools/platforms that are widely used at your institution in support of e-learning (e.g. CBT, PPT, email, discussion forums, quizzes, online courses, online assessment, online projects/collaboration works etc.)?
20. To what extent have you moved administrative systems such as admissions, registration, fee payments, exams through electronic media?

21. What has been the ‘teaching and learning’ impact of greater use of e-learning at your institution? And in your experience, which subject areas and learning activities are best suited to e-learning?

22. How do you think we can help teachers utilize e-Learning and what kind of training is required for teachers?

23. What are viewed as major barriers to further e-learning development at your institution?

24. Please comment on the attributes of learning environment that facilitates children to enjoy learning?

25. Your opinion on benefits of educational portal “Wonderwhizkids” in enhancing the learning environment in your school?
Appendix D

Student’s Questionnaire Data

Tabulated data in response to question no. 10 to 17
(Data values are presented in percentage)

10. Learning environment in which students enjoy learning and learn with understanding should be:

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>66.1</td>
<td>23.7</td>
<td>5</td>
<td>3</td>
<td>2.1</td>
</tr>
<tr>
<td>Motivating</td>
<td>64.1</td>
<td>27.7</td>
<td>4.6</td>
<td>2.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Interactive</td>
<td>75.8</td>
<td>15.7</td>
<td>5.9</td>
<td>1.9</td>
<td>8</td>
</tr>
<tr>
<td>Learner-centric</td>
<td>49.1</td>
<td>28</td>
<td>14.5</td>
<td>5.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Collaborative</td>
<td>45.9</td>
<td>27.4</td>
<td>14.3</td>
<td>5.8</td>
<td>6.6</td>
</tr>
</tbody>
</table>

11. Benefits of sharing Simple, Motivating, Interactive, Learner-centric environment

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>We enjoy learning if it is made simple and easy to understand</td>
<td>85.6</td>
<td>9.8</td>
<td>2.2</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Teaching with the aid of multimedia presentations makes learning interesting and engaging</td>
<td>63.4</td>
<td>29.2</td>
<td>4.1</td>
<td>1.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Interactive simulations improve understanding of difficult concepts and stimulates creative thinking</td>
<td>61.8</td>
<td>25.4</td>
<td>8.3</td>
<td>3.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Students should have the flexibility to learn anytime, anywhere at his own pace, to suit his learning preferences</td>
<td>57.3</td>
<td>22.8</td>
<td>9.3</td>
<td>5.7</td>
<td>4.9</td>
</tr>
<tr>
<td>Opinion</td>
<td>Very important</td>
<td>Important</td>
<td>Can't say</td>
<td>Not important</td>
<td>Not at all important</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>-----------</td>
<td>---------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Explaining the concepts with simple, interesting facts relevant to the world around us is</td>
<td>63.3</td>
<td>32.9</td>
<td>2.5</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Online quizzes with worked out examples and solutions to improve confidence and satisfaction are</td>
<td>40.2</td>
<td>44.5</td>
<td>10.8</td>
<td>3.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Interactivity in e-Learning facilitates learning by doing, which is</td>
<td>30.4</td>
<td>42.9</td>
<td>22.7</td>
<td>3.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Online learning, which helps in learning to learn through search engines such as Google, Wikipedia and educational portals such as BBC is</td>
<td>39.2</td>
<td>40.7</td>
<td>14.1</td>
<td>4.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Sharing knowledge with friends while doing projects on internet, which provides more learning opportunities is</td>
<td>62.4</td>
<td>28.9</td>
<td>5.3</td>
<td>1.9</td>
<td>1.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Highly Useful</th>
<th>Useful</th>
<th>Can't say</th>
<th>Not Useful</th>
<th>Not at all Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explaining the concepts through visual presentations to make learning simple and easy is</td>
<td>60.4</td>
<td>35.4</td>
<td>1.9</td>
<td>1.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Multimedia presentations, which make learning interesting and motivating are</td>
<td>39.3</td>
<td>50.3</td>
<td>6.9</td>
<td>2.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Interactive applets and animations to explain difficult concepts are</td>
<td>42.4</td>
<td>39</td>
<td>13.4</td>
<td>3.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Online learning, which offers flexibility to students to learn how to learn with their preferred learning style is</td>
<td>39.3</td>
<td>39.7</td>
<td>15.3</td>
<td>4.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Educational portals with open access, which extends learning opportunities to all are</td>
<td>40.9</td>
<td>39.5</td>
<td>14.2</td>
<td>2.9</td>
<td>2.5</td>
</tr>
</tbody>
</table>
14. Key elements: Content, Access, Technology and Collaboration

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to accredited, enriching content is important to enjoy learning</td>
<td>55.3</td>
<td>34.5</td>
<td>7.6</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Broadband access to internet is essential for more ways of learning</td>
<td>54.1</td>
<td>33.7</td>
<td>7.9</td>
<td>3.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Technology can make learning more joyful, interactive and collaborative</td>
<td>72.7</td>
<td>17.4</td>
<td>7.0</td>
<td>1.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Chat, discussion forums helps in learning together and sharing of knowledge</td>
<td>53.5</td>
<td>29.7</td>
<td>7.3</td>
<td>5.2</td>
<td>4.4</td>
</tr>
</tbody>
</table>

15.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher plays a very important role in making learning a joyful experience</td>
<td>86.5</td>
<td>10.1</td>
<td>1.4</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Portals with open access are extremely valuable to both students and teachers</td>
<td>47.4</td>
<td>43.7</td>
<td>6.5</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Networking of schools to share content and experience of teachers is important</td>
<td>57.1</td>
<td>29.1</td>
<td>9.6</td>
<td>2.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Students can have more flexibility in learning if classroom learning is combined with online learning</td>
<td>54.1</td>
<td>29.2</td>
<td>9.0</td>
<td>4.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Training for familiarity with computers, internet and other tools like Google and Wikipedia is important for improved learning</td>
<td>62.1</td>
<td>25.6</td>
<td>7.0</td>
<td>3.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>
16. My teacher: √ whichever is applicable (Total = 1467)

<table>
<thead>
<tr>
<th></th>
<th>No. responded</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Presents the material in an interesting way</td>
<td>1104</td>
</tr>
<tr>
<td>2.</td>
<td>Emphasized thinking rather than memorizing</td>
<td>1008</td>
</tr>
<tr>
<td>3.</td>
<td>Gave explanations that were clear</td>
<td>1142</td>
</tr>
<tr>
<td>4.</td>
<td>Helped me to improve my learning skills</td>
<td>1167</td>
</tr>
<tr>
<td></td>
<td>Provides me with useful feedback</td>
<td>1007</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>850</td>
</tr>
</tbody>
</table>

17. What subjects do you like to work on computers? (Total = 1467)

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>No. responded</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths</td>
<td>837</td>
<td>43.42</td>
</tr>
<tr>
<td>Physics</td>
<td>458</td>
<td>31.22</td>
</tr>
<tr>
<td>Chemistry</td>
<td>386</td>
<td>24.95</td>
</tr>
<tr>
<td>Biology</td>
<td>571</td>
<td>38.92</td>
</tr>
<tr>
<td>Others</td>
<td>403</td>
<td>27.47</td>
</tr>
</tbody>
</table>
Appendix E

Teacher's Questionnaire Data

Tabulated data in response to question no. 13 to 23
(Data values are presented in percentage)

13. Learning environment in which students enjoy learning and learn with understanding should be:

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>83.3</td>
<td>9.8</td>
<td>3.9</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Stimulating</td>
<td>94.2</td>
<td>4.8</td>
<td>0</td>
<td>1.0</td>
<td>0</td>
</tr>
<tr>
<td>Interactive</td>
<td>77.9</td>
<td>16.3</td>
<td>2.9</td>
<td>2.9</td>
<td>0</td>
</tr>
<tr>
<td>Amencric</td>
<td>67.7</td>
<td>20.2</td>
<td>6.1</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Collaborative</td>
<td>71.7</td>
<td>17.2</td>
<td>1.0</td>
<td>4.0</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Benefits of sharing Simple, Motivating, Interactive Learner-centric environment

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students enjoy learning if teacher plainly the subject matter through simple concepts and interesting facts related to social context of the learner</td>
<td>95.3</td>
<td>3.7</td>
<td>0.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Teaching with the aid of multimedia presentations makes learning interesting and engaging</td>
<td>72.0</td>
<td>26.2</td>
<td>0.9</td>
<td>0.9</td>
<td>0</td>
</tr>
<tr>
<td>Interactive simulations help children to develop curiosity and critical thinking</td>
<td>92.5</td>
<td>5.7</td>
<td>1.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exploring the subject through locational portals and other online sources such as Wikipedia doing projects facilitates learning in students</td>
<td>57.7</td>
<td>28.8</td>
<td>4.8</td>
<td>8.7</td>
<td>0</td>
</tr>
<tr>
<td>Shared resources including online libraries and educational portals help teachers to be more innovative</td>
<td>83.7</td>
<td>14.4</td>
<td>1.0</td>
<td>1.0</td>
<td>0</td>
</tr>
</tbody>
</table>
### 15.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Very Important</th>
<th>Important</th>
<th>Can't say</th>
<th>Not important</th>
<th>Not at all important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content structuring and sequencing to move from simple to increased levels of complexity is</td>
<td>78.8</td>
<td>21.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Images and pictures entered around a theme along with animations to explain concepts are</td>
<td>39.6</td>
<td>56.6</td>
<td>0.9</td>
<td>2.8</td>
<td>0</td>
</tr>
<tr>
<td>Simulations of experiments difficult to perform in lab such as total internal reflection are</td>
<td>34.4</td>
<td>42.7</td>
<td>11.5</td>
<td>10.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Flexibility in learning through access to varied but accredited content from open source such as BBC is</td>
<td>22.4</td>
<td>45.9</td>
<td>23.5</td>
<td>2.0</td>
<td>6.1</td>
</tr>
<tr>
<td>Collaboration among schools in sharing best practices in teaching and content is</td>
<td>50.0</td>
<td>47.1</td>
<td>1.9</td>
<td>1.0</td>
<td>0</td>
</tr>
</tbody>
</table>

### 16.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Highly Useful</th>
<th>Useful</th>
<th>Can't say</th>
<th>Not Useful</th>
<th>Not at all Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students enjoy learning with a simple, easy to understand images, graphics, animations and simulations are</td>
<td>55.1</td>
<td>43.9</td>
<td>0.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Games that simulate applications in real life, which make learning interesting while being relevant and meaningful are</td>
<td>39.6</td>
<td>58.5</td>
<td>0.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Interactive simulations to explain concepts like Interference and Polarization are</td>
<td>36.6</td>
<td>53.8</td>
<td>9.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Quizzes along with worked out solutions that enable learners to assess their own understanding are</td>
<td>44.3</td>
<td>55.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Virtual classrooms, which extend the reach of expert teachers and facilitates learning for wider audience are</td>
<td>50.5</td>
<td>43.7</td>
<td>4.9</td>
<td>1.0</td>
<td>0</td>
</tr>
</tbody>
</table>
17. Key elements: Content, Access, Technology and Collaboration

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media rich, accredited content such as simulations and animations helps teachers to be innovative and creative.</td>
<td>93.5</td>
<td>5.6</td>
<td>0.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Programs such as EDUSAT, which provide video lectures of expert teachers are highly useful.</td>
<td>65.4</td>
<td>28.0</td>
<td>5.6</td>
<td>0</td>
<td>0.9</td>
</tr>
<tr>
<td>Technology provides tools to enhance classroom experience and share knowledge</td>
<td>80.0</td>
<td>14.3</td>
<td>2.9</td>
<td>1.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Collaboration helps in sharing best practices and innovate ways of teaching</td>
<td>83.5</td>
<td>15.5</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

18.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Agree</th>
<th>Slightly agree</th>
<th>Neither agree nor disagree</th>
<th>Slightly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher will be at the heart of transformation in learning to facilitate every student to enjoy learning and achieve his/her full potential</td>
<td>98.1</td>
<td>1.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Educational portals with accredited and relevant content such as BBC and WonderWhizKids are highly useful.</td>
<td>56.3</td>
<td>38.5</td>
<td>3.1</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Networking of schools to collaborate and share the learning modules and best practices of other schools is important.</td>
<td>71.7</td>
<td>23.6</td>
<td>2.8</td>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>Flexibility in curriculum and assessment facilitates teachers to be more creative in meeting diverse learners needs.</td>
<td>76.4</td>
<td>19.8</td>
<td>1.9</td>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>Training for familiarity with computers, internet and other software tools is important for innovation in teaching.</td>
<td>80.2</td>
<td>17.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0</td>
</tr>
</tbody>
</table>
20. Satellite based broadcasts of video lectures by experts extends learning opportunities to more students

TOTAL RESPONDED: 105

- Strongly Agree: 25.7%
- Agree: 64.8%
- Somewhat Agree: 9.5%
- Disagree: 0.00%
- Strongly Disagree: 0.00%

21. Broadband access to internet is essential for the success of e-Learning

TOTAL RESPONDED: 95

- Strongly Agree: 28.4%
- Agree: 65.3%
- Somewhat Agree: 6.3%
- Disagree: 0.00%
- Strongly Disagree: 0.00%

22. Do you think technology helps you to be innovative and creative?

Total responded: 105, 100%

23. Does technology help you to enjoy teaching?

Total responded: 105, yes: 98.1%
Appendix F

Implementation of Non-linearity and interactivity in e-Learning

A. Vidyasagar
sagar@avantelsofttech.com

About the author:

Presently working as Managing Director for Avantel Softtech Ltd., Hyderabad, he is overall head of the company and overseeing various facets of the organization such as R&D, Production, Finance, Marketing, and Human Resources. He has also worked as General Manager for Satyam Computer Services Ltd., Hyderabad. Mr. Vidyasagar received his B.Tech from JNTU, Kakinada. M.Tech degree from IIT, Karagpur and MBA from Osmania University, Hyderabad. He has designed circuits and micro electronic modules for fighter aircrafts and electronic warfare systems. He has also designed communication equipment for ground-to-air and air-to-air communication in fighter aircrafts. Mr. Vidyasagar established a Software technology Park in Chennai for software export through dedicated high-speed data communication link to U.S.A.

Abstract

In this paper, we will discuss three aspects. Initially, we will explain the methods used for developing interactive content. Then we will detail the technology elements that we incorporated in our learning environment. Finally, we also described the simulations that we developed for providing high degree of experience to the students.

The architecture used in WWK is Model View Controller architecture. Java applets and Flash animations are extensively used for interactive simulations. All components for use, operations, maintenance and content development are accessible via web-enabled devices. using web (http) protocols for access.

1. Introduction

“Wonder Whiz Kids” creates an innovative inquiry based, interactive learning environment to acquire knowledge, gain insights and think intuitively. WWK is for students of age 12 years and above parents, teachers and all those who are interested in promotion of science and scientific thinking. The main features of this portal are visualization, concept related content sequencing, interactive and collaborative learning, self-assessment, games and simulations. The content would be informative interesting and interactive to sustain and enhance the span of attention while helping the student to understand the fundamental concepts of science and apply them gainfully to real world situations.

2. Content creation

2.1 Concept related content sequencing—-Structuring

Content sequencing is the efficient ordering of content in such a way so as to facilitate the learning process. There are several general methods of sequencing content.

One well-known method is concept-related content, which is described by Posner and Strike [1]. The concept related scheme suggests sequencing based on the relationships between concepts.

A definition of “concept” based on Bloom’s model for Mastery Learning [2] is as follows: “A concept is a semantically meaningful unit of instruction with a specific intent type and a matching instruction and evaluation type.” A concept must have clear learning objectives. This will make sure that the concepts have a reasonable breadth and depth.

The concept sequencing is based on a concept related strategy. The subject matter expert identify the various concepts, which constitute the course content. WWK provides the course designer with an
SA provides the means of evaluating the student's acquired knowledge and valuable feedback regarding his performance (the grade, a bar graph, the correct answers etc).

SA is a highly dynamic component of the Wonderwhizkids methodology, involving both synchronous and asynchronous communication between students and instructor. In order to build a model of SA, we analyzed the assessment process, different possible scenarios, relationships between different concepts and different assessment types.

3.3 Games

Game-based learning is proving the most engaging and effective means of acquiring new knowledge and stimulating new thinking. Learner tends to be more involved. Learner interacts with game and concentrates on learning the material. Learners think it's great, since they are learning and enjoying themselves at the same time an unprecedented combination.

WWK provides games like cross word, memory game for each sub topic. Interactive presentation of material provided within a game-like framework.

Fig: 3 Crossword Game - Topic wise

3.4 Non-linearity — Search, Keywords, bookmarks, Notes

Search: The student while going through the lesson can branch (take a detour) at designated points to delve more deeply into the subject for a greater clarity.

Bookmarks: WWK also provides the student with the ability to bookmark topics within a course. A student must explicitly state which topics he wishes to bookmark. He may also specify a short one-line description for the topic that he creates a bookmark for. The default description is the name of the topic. A student may jump to a bookmark at any time during the course.

Notes: Since only a single line description can be added in a bookmark, this is often insufficient for a student to keep track of his thoughts while going through a topic. A note-keeping feature has been provided for this purpose. Just like a student would carry a notebook to a class and note down points of interest, or things that he may want to look at later, WWK provides students with a notepad like interface for adding notes to a given topic. Any number of notes may be added to a topic, and all notes for a topic are listed sequentially when requested.

Using the above-mentioned memory features, a student can move around the course in any order that he wishes. A student may move back and forth between sections, in essence, creating his own hyperlinks in the content. These are private to the student and are not reflected in other students' profiles.

3.5 Real world applications —— Explore

The implementation of the learned concept in the real world applications is clearly explained in the Explore link.

Fig: 4 Selective Reflection

Selective Reflection

Polar bears have white coat of fur but their skin is black in colour. Why?

Polar bears are found in the Arctic Circle, which is an icy continent near the North Pole. Arctic Circle is always filled with ice, snow and glaciers. To polar bear is an inhabitant of the arctic region. The white coat of fur on the polar bear helps him camouflage as his white surroundings. Its coat also provides him with good insulation against the harsh Arctic conditions. But to absorb all the sunlight that is available to him, his skin is black in colour - black is the colour that comes about because absorption of all the sun's visible colours. It perhaps due to evolutionary conditions (as well as Physics) that polar bears have white coat of fur but their skin is black in colour.
3.6 Collaborative content development — File upload area

WWK enables subject matter experts, learners to participate in the course from varied locations through the ‘File upload area’ feature. The content manager sees the uploaded content and do necessary changes and include in the main course.

4. Simulations

An area where WWK has spent substantial time is in developing simulations for standard experiments. Since context and practice are two keys in retaining and applying knowledge, simulations provide a means for the student to have hands-on experience without the costs or risks involved in working in a “live” environment.

In e-learning, simulations strive to recreate the student’s work environment. They solve three primary purposes that regular lab experiments cannot provide.

- Better visualization: Experiments may not always clearly demonstrate what happens within the apparatus as it is closed. Students mostly see the end results. Simulations on the other hand can be used to demonstrate the effects in all stages.

For example, a telescope has a lot of phenomenon taking place within the tube. In an live experiment, what the student sees is that object that is far off is appears at a reduced distance when viewed through the telescope.

In a simulation, however, the image formation at every stage can be shown and the student can actually vary the distances to study the effect.

- Approximations and varying initial conditions:

In lab experiments, students aim to reproduce the ideality and verify the theoretical values. However, many a times the students will benefit and gain an overall understanding of the process if he/she can change the initial conditions or the environment.

For example, let us consider a refractive index experiment. Typical lab experiments are aimed at measuring the refractive index of a medium (water, alcohol or some other liquid). But, if the student must understand the effect of the density of the medium or the wavelength of the incident light on refractive index, constructing lab experiments will be extremely cumbersome and time consuming.

![Fig: 6 Refraction of light in different Media](image)

However, through a simulation these changes can be easily implemented and the student will gain the ability to approximate.

- Experiments that are impossible to perform in real world

Conditions like absolute zero, frictionless surfaces can be very effectively simulated. These can never be obtained in real world and any experiment constructed is just an approximation.
However, a properly designed simulation can show the student how the motion gets closer to the physical laws he studied when the friction of the surface goes down.

This is also a great way to answer few of the simple but curious questions that students have.

A standard question that student has is as follows: Earth is moving at a speed. So, if I jump and some how stay in air for long enough, can I not just travel to any spot I want.

A simulation showing motion of earth and the weather around it and how the object revolves even if it is not in contact with the surface will explain such concepts clearly to the students.

All our simulations are applets. An applet is a little application. On the web, an applet is a small program that can be sent along with a web page to a user. E.g. Java applets can perform interactive animations, immediate calculations, or other simple tasks without having to send a user request back to the server.

5. Conclusions

E-Learning environment with application of e-tools like Flash animations, Java applets promotes visualization of concepts and help students gain insights through interactive simulations. Non-linearity in content sequencing enables interactive, flexible learning along with application of concepts in everyday life through features like keywords, search and explore.

12. References


Appendix G

E-Learning strategy in "Wonderwhizkids" – a science portal

A. Vidyu Sagar
sagar@avanteleoftech.com

Abstract

"Wonder Whiz Kids" initiative is an attempt by the author to build and deliver science content for students to promote scientific world view and reinforce concepts already being taught in schools.

Salient features of cognitive and motivational learning models have been integrated to create an environment that is motivating.

The strategic framework has been named as "SMILE" (Simple, Motivating, Interactive Learning Environment) [13]. The environment is learner centric and offers him more control over the content, sequence and pace of learning. SMILE is consistent with popular learning models namely cognitive load theory and ARCS model of Keller. WWK has been designed and implemented to address the learning needs of students from all over the world. The content is presented with analogies, examples and applications that have universal appeal.

Introduction

Learner’s requirements and preferences have been obtained from students through a structured questionnaire and survey from which the key components of the learning environment have been formulated.

Students have been asked to identify the areas for improvement in the existing learning methods and suggest new ideas to enhance their interest and motivation to learn. Most of the students preferred graphics rich content, interactive applets, animations, games, quizzes and tests for self-assessment. Based on the inputs from the survey, WWK team arrived at web-based learning model called "SMILE" (Simple Motivating Interactive Learning Environment).

"Wonder Whiz Kids" creates an inquiry based, interactive learning environment to acquire knowledge and gain insight. WWK is for students of age 12 years and above, parents, teachers and all those who are interested in promotion of science and scientific thinking. The main features of this portal are visualization, concept related content sequencing, interactive and collaborative learning, self-assessment, games and simulations. The content would be simple, interesting and interactive to sustain and enhance the span of attention while helping the student to understand the fundamental concepts of science and learn to apply them gainfully in real world situations.

Approach

"Integrating the salient features of cognitive and motivational learning models through non-linear content delivered in an integrated learning environment to enhance absorption, retention and performance."

Problem Statement

Web-based learning faces motivational challenges due to lower levels of interactivity and isolated feeling of learners as compared to classroom environment where interactions with the teacher and other students are very high.

We need to address these challenges in on-line learning by actively involving students through an interactive environment. A successful solution shall be simple and make them effectively relate their knowledge in real world situations. So, the challenge is to create an environment, which is simple, motivating and interactive.
Product position statement

Wonder Whiz Kids is a science portal for students who want to gain conceptual understanding and improve their performance in school. The higher open-ended goal is to develop a scientific worldview. Wonder Whiz Kids helps children to experience a sense of belonging to a large family of life with respect and love for 'Nature' and its beings.

Intended Audience

Primary: Students  Average Age: 12 - 16 Years
Secondary: Parents and Teachers.

Product Overview

Student goals
- Understanding scientific principles / concepts in an engaging way.
- Learn to apply the concepts - Know why?
- Visualize the process and elements of science - Applets, Animations.
- Set the feedback - Q & A.

Product perspective
- Self - Directed
- Self paced learning
- Interactive
- Collaborative
- Self assessment
- Examples and Applications
- Non-linearity

Content Structure

The content is structured in a manner that enhances long-term retention. This portal helps students in
- Firm understanding of the basics of the subject.
- Think critically.
- Ready to apply the concepts to real world problems.

Summary of capabilities
- Grasp of fundamentals.
- Interactive learning through applets / animations.
- Shared knowledge - Chat.
- Self assessment - Q&A
- Applications - Know why

Product Features

The following table details the feature list mapped against the three aspect of above definition: absorption, retention and performance. The technology has been selected in keeping with the delivery of the features in an integrated learning environment.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Feature</th>
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<tbody>
<tr>
<td>Profiling</td>
<td>Book marking</td>
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<td>History Maintenance</td>
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<td>Content</td>
<td>Non linear Course material</td>
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<td>Concept Related</td>
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<td>Q &amp; A</td>
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<td>Feedback</td>
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<td>Generic</td>
<td>Search</td>
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Learning Models in WWK

Cognitive Load Theory

Cognitive Load Theory suggests increase in germane cognitive load, which shall encourage schema construction and schema automation for the concepts that are consistent and relevant across varying problem situations. The ability to identify similar and relevant features in varying situations yields better schema construction and enhances problem solving skills and knowledge transfer. [1,2,3,4]

Cognitive Load Theory states that learning will be maximized by reducing levels of extraneous cognitive load and thereby ensuring that much of a learner's working memory is free.

Content design and sequencing that graduates from simple to increased levels of complexity may alter...
intrinsic cognitive load and reduce extraneous cognitive load.

Interactive components like applets help the student to actively interact and involve in the process of understanding which stimulates schema construction of concepts and there by increase germane cognitive load. However the learning outcomes of these visual simulations depends on the level of expertise of learners. The continuous real time assessment of learning expertise level is required to enable students adapt the pace and level of learning to suit their level of expertise.

Cognitive load theory provides instructional designing principles for structuring information, which facilitates building knowledge in long-term memory. People can learn more in less time by using someone else’s previously acquired knowledge explained through a worked out example [John Sweller]. Worked out solutions and varying levels of questions are introduced in self-assessment for adaptive e-Learning. Questions with different levels of complexity are framed in self-assessment tests to suit various levels of learner’s expertise. Worked out solutions are provided for questions that demand high level of expertise. This helps in assessing the level of expertise and progress of the student.

The endeavor of this WWK initiative is to enrich the body of knowledge in long-term memory that helps students to be more creative in problem solving and application of knowledge so gained in real world situations. Every kid can be a “Wonder Whiz Kid” by expanding schemas (information networks) in their brain and achieve a high level of automation in performance.

Relevance refers to the alignment of content with the learner’s goal, learning styles, past experience and its application in real world situations. WWK tries to address the intrinsic goals of students by designing the content to be simple, interesting and motivating. This is achieved through “Know Why?” feature, which gives examples and applications for intrinsically interesting topics, which they can relate in daily life situations.

Confidence can be accomplished by helping students to experience success through understanding of the concepts and their ability to apply these concepts for problem solving. Quizzes and Games help them in self assessment and improvement of their scores over a period of time and they can attribute the success to their own abilities and efforts rather than luck.

Satisfaction is necessary for learners to have positive feelings about their learning experiences. The student’s satisfaction could be achieved by helping them perform better in their schools while satisfying the quest for knowledge and spirit of inquiry.

Content sequencing strategies:
Posner and Strike [7] described a set of strategies for sequencing the instruction based on learning related, world related and concept related content. The model adopted in WWK accommodates various strategies by presenting the content in a non-linear way. Logical pre-requisite sequencing is embedded in concept related sequencing while “Explore” and “Key Words” provide for learner interests (learner related) and link to the experiences in real-world (World related). “Know why” feature helps in understanding the possible contents for utilization of the concept and apply them to solve real world situations.

Bloom [8] demonstrated that if time is not held constant for all learners then a student’s mastery of prerequisite skills, rather than aptitude is a better predictor of school learning. So students shall be given enough time to learn and are provided by quality instruction. Quality instruction requires that the subject matter should be organized into manageable learning units with specific learning objective followed by assessment and feedback.

WWW portal provides opportunity for self-paced learning and structured content in small modules with appropriate sequencing. The overall design of the content also captures some of the conditions for
learning suggested by Gagne [9,10]. Each lesson has been started with a thought provoking question or interesting facts centered around a theme.

Architecture

LAMP: Linux, Apache, MySQL and PHP. The LAMP acronym denotes a particular set of open source solution to build a web and distributed computing infrastructure. It is based on Linux as the core operating system and a conventional 3-tier architecture, with Apache as the Web Server, application servers implemented in PHP and MySQL as the back-end database.

Linux is widely deployed and available on different hardware platforms. Apache is the most popular web server, most often deployed on the Linux platform. The pair has been proven to be stable and scalable for all but the largest applications, and should provide an adequate infrastructure for building the e-Learning Portal.

There is a diverse collection of core tools available for each of the different application service alternatives (Perl, PHP, Python), including content management, collaboration, scripting, interface personalization, and e-commerce. There is no particular strong case for the selection of any option for the application server layer.

LAMP's strength is that it is an open-source approach and there are many options and alternatives available. It provides a flexible structure that can be modified and adapted as appropriate. Open-source approach and services such as security, transaction and session control are not important.

LAMP is a flexible, open-source approach and services such as security, transaction and session control are not important [11].

Content Management

WWK's Content Management System (CMS) [12] enables easy uploading of the data by the domain experts with an email like interface. As all the content is stored in a database and the design and content are treated as separate modules, the content can be added very easily.

PHP, MySQL is used as the framework for building the CMS.

The CMS contains all the latest communication features that are needed to enrich a powerful information and knowledge disseminating site. The features include but not restricted to:

1. Web page management
2. Blog
3. Mailing lists/Newsletter
4. RSS feeds
5. Web analytics
6. Sequential auto responders

As WWK is a powerful learning site, a Quiz module is added to plug into the content management system. The quiz is intelligent and keeps track of the performance of individual students.

The CMS is built in an open-ended mode. So, that in future any new feature can be added as a plug-in and the features grow along with the technology development.

Simulations

WWK developed simulations for standard experiments and animations for basic concepts. Since context and practice are two keys in retaining and applying knowledge, simulations provide a means for the student to have hands-on experience without the costs or risks involved in working in a "live" environment.

In e-Learning, simulations strive to recreate the student's work environment. They solve three primary purposes that regular lab experiments cannot provide.

- Better visualization: Experiments may not always clearly demonstrate what happens within the apparatus as it is closed. Students mostly see the end results. Simulations on the other hand can be used to demonstrate the effects in all stages [14].

For example, a telescope has a lot of phenomenon taking place within the tube. In a live experiment, what the student sees is that object that is far off appears at a reduced distance when viewed through the telescope.

Learning
In flash animations, the ability of carbon atom to undergo different types of hybridization to form millions of organic compounds is clearly demonstrated.

In a simulation, however, the image formation at every stage can be shown and the student can actually vary the distances to study the effect.

For example, let us consider a refractive index experiment. Typical lab experiments are aimed at measuring the refractive index of a medium (water, alcohol or some other liquid). But, if the student must understand the effect of the density of the medium or the wavelength of the incident light on refractive index, constructing lab experiments will be extremely cumbersome and time consuming.

However, through a simulation these changes can be easily implemented and the student will gain the ability to approximate.

- Experiments that are impossible to perform in real world:

  All our simulations are applets. An applet is a little application. On the web, an applet is a small program that can be sent along with a web page to a user. E.g. Java applets can perform interactive animations, immediate calculations, or other simple tasks without having to send a user request back to the server.

Conclusions

Wonder Whiz Kids Making the Difference

No one knows exactly what the future holds, but there is little doubt that skilful use of their minds will be an important part of their future. The skilled use of minds would definitely in large part, call for strong basics, a grasp on fundamentals that student doesn’t go back to now and then but takes them forward for a better life. Technology can make learning more interactive, enhance the learning experience and facilitate collaborative learning. The effectiveness of
technology enabled learning experience depends on
the design of the application and the instructional
methods including content structuring and
sequencing.

SMIL: E integrates the cognitive and motivational
learning models to create a learner environment that
is learner centric and motivating.

E-tools like Flash animations, Java applets promote
visualization of concepts and help students gain
insights through interactive simulations. Retention
can be enhanced through clear understanding of the
concepts and their applications in real world
situations.

Non-linearity in content sequencing enables
interactive, flexible learning along with application of
concepts in everyday life through features like
keywords, search and explore.

The access to WWK is free. WWK invites students
and teachers across the world to become part of this
community to collaborate and contribute. Controlled
experiments are yet to be conducted in schools to
evaluate the effectiveness of the portal in enhancing
the performance of students and meet their intrinsic
needs to know and learn about the world we belong to.

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About the Author

Vidya Sugar Abburi, Managing Director, Avantel Softech Ltd., is a postgraduate in Engineering and Management with experience in design and development of Avionics equipment.

In 1993, he started Avantel Softech Ltd to build a technology base for design and development of wireless products. Avantel now has a world-class infrastructure for design, manufacture and development of Wireless Products for Defence, Telecom and Satcom applications.

He is the Founder Director of Knowledge Insight Dissemination Systems Ltd., an e-learning company.
Appendix H

SMILE - Learning Strategy for the digital Age

Authors:
A. Vidya Sagar
Maj Gen (Dr) RK Bagga
Dr. M.S. Bhat

About the authors:
A. Vidya Sagar, M.Tech (Micro Electronics) IIT Kharagpur, MBA (O.U), is presently the Managing Director of Avantel Softtech Ltd., Hyderabad. He is the Founder Director of Knowledge Insight Dissemination Systems Ltd, an e-learning company and creator of an educational portal namely www.wonderwhizkids.com. ‘Wonder Whiz Kids’ creates an inquiry based, interactive learning environment to acquire knowledge and gain insight.

Maj Gen (Dr) RK Bagga, AVSM (Retd), is presently Advisor (Outreach), International Institute of Information Technology, Hyderabad. He has held various important apps including Director DRIIT Computer Center and Chairman, IT Area, Administrative Staff College of India, Hyderabad.

Dr. M.S. Bhat, B.E(HSc.), M.Tech(JNTU), PGDM(AlMA), Ph.D(O.U) Professor, Marketing, Organizational Behavior, Technology Management. Dr. Bhat did his Ph.D. in Business Management from Osmania University, Hyderabad, M.Tech in Industrial Engineering and Management from JNT University, Hyderabad, B.E from Indian Institute of Science, Bangalore and Diploma in Management from All India Management Association, New Delhi. Had more than two decades of Industrial experience. Has been working as Professor of Management Science in JNTU since 1992.

Keywords
e-Learning, Strategy, Learning environment, Simple, Motivating, Interactive, Learner-centric, Knowledge age, Collaborative learning, Learn to learn.

Abstract

Learning strategy for the knowledge age shapes the vision of learning for future where in every student enjoys learning with smile.

The strategy is to create an environment in which unique value is created for every learner. The value comes from arbitrage of intelligence migration through educational portals and aggregation of open educational resources through shared infrastructure. Networking offers learners, varied forms of engagement with different sources of knowledge. Reassembly of the learning modules by the teacher enables innovation in teaching in a way appropriate to the learner and the context.

SMILE is an acronym for simple, motivating, interactive and learner centric environment. SMILE transforms learning and teaching by harnessing technology to implement established learning theories with creativity and innovation. Content, technology, access and collaboration are key elements of the strategy. Teacher is at the heart of the strategy and his/her commitment is essential to create and sustain the SMILE. Share the SMILE to learn with smile sums up the strategy to create an environment in which learning is a joyful experience by collaborating to create and share the knowledge [1, 2].
Knowledge dissemination in the Digital Age:

"The learning environment should help people share their knowledge: to learn from each other, to innovate and work together effectively to make a difference" --- David Gurteen.

Preparing students for an unpredictable world will take, above all things, vision. Inherent in this vision are several key realizations: that we are working to prepare a new kind of student; that we are using brand new tools, for a life that we cannot clearly see, anticipate or describe today; that embedded in this challenge are fantastic opportunities; and that teaching should and could be the most exciting profession on the planet [3] (Warlick 2001).

Life long learning is essential in the “Knowledge age” as everyone needs to update his knowledge to remain relevant and productive in the new economy. Learning strategy needs to be different in the digital age to leverage advances in ICT for innovative learning solutions, which facilitate “learning to learn.” Learning to learn helps us to pursue life long learning and enjoy learning.

Jennifer Rowley [19] defines the relationship between information, learning and knowledge and proposes a simple model, which makes this relationship explicit. Information is accepted into the organization from different sources. The organization or an individual conceptualizes that information in a way that is consistent with its norms, cognitive frameworks, context and cultures. This conceptualization process can be described as learning. Learning leads to knowledge, which may be either tacit (embedded in minds and activities) or explicit (stated as in verbal communications or in documents). Knowledge is available to support and inform decisions, behavior and actions. The final stage is the feedback from the actions, which in turn may generate further information, which form the basis for further learning. In the constructivist perspective, learning is a process of the construction of knowledge and learners actively construct their own knowledge by connecting new ideas to existing ideas, while being engaged in the process of learning. Active engagement involves enquiry, exploration, application and reflection, leading to construction of knowledge. So it is important to create an environment for active, engaging, personalized, collaborative learning that leads to effective knowledge creation and dissemination.

The digital revolution has intensified the move towards knowledge codification and sharing of codified information resources from universally accessible digital libraries connected through communications networks. The knowledge-based economy is characterized by the need for continuous learning of both codified information and the competencies to use this information. The capabilities for recognizing patterns, interpreting and decoding information codified through information technologies can only be done through learning.

Importance of Learning environment:

Studies conducted in developed countries such as U.K. and Australia [5, 15] reveal that e-learning had a positive impact in transforming learning, empowering learners and teachers and prepare students to face the future with confidence. Studies further suggested that even though infrastructure such as computers, networks and broadband internet access are essential for the success of e-learning initiatives, they are not sufficient. We need to create a learning environment that helps students enjoy learning and learn how to learn.

National Curriculum Framework 2005 [14] and earlier studies conducted by Government of India suggest that we should take initiatives to provide “Learning without burden” to every student. The learning should be a joyful experience helping students learn to learn. The recommendations include systemic reforms and integration of educational technologies wherever they are found useful. They suggest a learning environment, which is learner-centric with learning flexibility.
Albert Einstein once said "I never teach my pupils; I provide only conditions in which they learn." We need to create an environment that helps students enjoy learning, find learning relevant and meaningful, develop skills to learn how to learn and constantly think out of the box to solve problems of real world situations by applying their knowledge in different ways. Technology is helping us to think innovatively in creating and sharing knowledge. The knowledge grows exponentially with sharing and collaboration in a networked world. Sharing the learning environment and knowledge through collaboration enhances learning opportunities for all so that every student learns with smile to achieve his/her full potential.

**SMILE** is an acronym for simple, motivating, interactive and learner centric environment. **SMILE** blends the best of both the worlds - classroom learning and network enabled e-learning. Learning theories, models and the science of instruction are embedded in **SMILE** to create an environment that empowers learners and teachers. **SMILE** transforms learning and teaching by harnessing technology to implement established learning theories with creativity and innovation. We need to share the **SMILE** to maximize the knowledge capital and the access to it through collaboration. Learning process would be efficient and effective if the learning environment offers all the four essential ways of learning namely -learning from teacher, self motivated learning, social learning and experiential learning. **SMILE** integrates the cognitive, constructive, experiential and elaboration learning theories [4, 13] with motivational learning model to create a learning environment that is simple, motivating, interactive and learner centric. The content design, development and delivery shall be guided by the principles of **SMILE** which is a highly flexible framework providing lot of scope for the teachers, subject matter experts and instruction designers to chose a right mix of learning concepts appropriate to the context.

**Simple:**

Learning with understanding requires the teacher to present and explain the concepts to learners in a simple way, which is easy to understand. This is the most challenging yet interesting competency expected from teacher in an effective learning environment, which facilitates learning without burden and learning with smile. This kind of environment ensures that every student enjoys learning and hence achieves his/her potential.

Subject matter explained through simple concepts with different applications in real world encourages schema construction and schema automation for the concepts that are consistent and relevant across varying situations. The ability to identify similar and relevant features in varying situations yields better schema construction and enhances problem solving skills and knowledge transfer.

**Motivating:**

Keller [7] suggests that students will be motivated to learn when they perceive some personal value and satisfaction from the effort, and when they expect to succeed. Based on these two principles from expectancy-value theory and extending them, Keller came up with four basic elements of motivational theory: attention, relevance, confidence, and satisfaction. Attention can be gained and sustained through graphics, images, animations, applets, interesting facts and thought provoking questions to stimulate a sense of inquiry and curiosity. Relevance refers to the alignment of content with the learner's goal, learning styles, past experience and its application in real world situations. Confidence can be accomplished by helping students to experience success through understanding of the concepts and their ability to apply these concepts for problem solving. Satisfaction is necessary for learners to have positive feelings about their learning experiences. The student's satisfaction could be achieved by helping them perform better in their educational institutes while satisfying the quest for knowledge and spirit of inquiry.

**Interactive:**

Collaboration and interaction among learners is a very important component of effective learning. Simulations, streamed video, project teams, chat rooms, bulletin boards, online references, personalized coaching, and email
are some techniques that could help create an interactive online environment. Interactive learning can be stimulating and encourage critical thinking as it facilitates problem solving. E-tools like Flash animations, Java applets promote visualization of concepts and help students gain insights through interactive simulations. Retention can be enhanced through clear understanding of the concepts and their applications in real world situations. Interactive components like applets help the student to actively interact and involve in the process of understanding which stimulates schema construction of concepts [5, 13] and there by increase germane cognitive load [5, 11]. However the learning outcomes of these visual simulations depends on the level of expertise of learners. Non-linearity in content sequencing of web based learning portals enables interactive, flexible learning through features like keywords, search and explore.

Learner- Centric:

Learning is an active process in which meaning is developed on the basis of experience [16]. Learners actively construct their own knowledge by connecting new ideas to existing ideas on the basis of their experience while structuring and restructuring of ideas is an essential part of the learning process. Learner centric pedagogy gives primacy to learner’s interests, experiences, preferred learning style and their active participation. The content design should enable learners to construct knowledge from their own experience in their own way and develop multiple perspectives. Learner centric approach also allows learners to learn at their own pace and to engage with concepts, reflect on the underlying cause and effect relations, patterns, similarities and interconnections to deepen understanding. Active engagement involves enquiry, exploration, questioning, debates and reflection, leading to theory building and the creation of ideas. So the focus should be on the underlying principles of how knowledge is created, how it is organized and how it is used and on how learners engage with and reconstruct knowledge.

Why do we need a Strategy?

We need a learning strategy to implement SMILE and unify the initiatives by Government, industry, educationists and educational institutes, that extends the reach of quality education to all and prepare ourselves through our education system to cope with an ever-changing world. The strategy should help shape the vision of learning for future where in every student enjoys learning with smile, free from stress caused by learning without understanding. We need to balance e-learning with traditional methods, using technology as an enabling tool to enrich the learning process.

Purpose:

Every student learns with smile to achieve her/his full potential. We need to create and provide access for all to a learning environment that helps students learn how to learn and achieve their full potential.

Strategic vision:

In the knowledge age creation of wealth will largely be determined by how one continuously acquires and applies knowledge to the changing needs of the society. So we need to work towards an education system which prepares students for life long learning. This requires an environment in which students enjoy learning, develop curiosity, learn how to learn by learning to share and sharing to learn.
Strategic Objectives:

Enjoy learning:

Learning flexibility with control over the learning process, learning by doing through projects and simulations, learning together by sharing knowledge, interaction and collaboration and learning with understanding by learning how to learn makes learning enjoyable. Innovation in teaching and learning by leveraging technology helps us to enhance the learning experience of students. Technology facilitates presentation of subject matter with graphics, 3D animations and simulations. These multimedia presentations help teachers to explain the complex concepts in a way, which is simple and easy to understand and make learning interesting and enjoyable.

Learn To learn:

Learning to Learn is a process of discovery about learning which involves a set of principles and skills that help learners learn more effectively and so become learners for life. Learning to Learn offers pupils an awareness of how they prefer to learn and their learning strengths; how they can motivate themselves and have the self-confidence to succeed; things they should consider such as the importance of a positive environment for learning; some of the specific strategies they can use, for example to improve their memory or make sense of complex information; and some of the habits they should develop, such as reflecting on their learning so as to improve next time. Learning to learn approaches are enabling educational Institutes to develop their pupils as confident, successful lifelong learners.

Collaborative Learning:

The collaborative learning brings learners, teachers, specialist communities and experts together to share ideas and good practice, contributing to new knowledge and learning. Shared resources including online libraries and educational portals help teachers to be more innovative. E-learning offers a wide range of online environments from school, college, home or to learn from other individuals or groups of learners as well as tutors, and develop the cognitive and social skills of communicating and collaborating. Collaborative learning provides scope for negotiation of meaning, sharing of multiple views and changing the internal representation of the external reality.

Active Learning:

Active learning is learning by doing. It is learning through experiencing situations and solving problems, instead of being told the answers by someone else. Active learning enables students to take responsibility for what and how they learn, achieving their personal goals as self-directed learners. Active learning helps in engaging with real world applications of the concepts and deepen understanding to acquire new layers of meaning. This kind of learning provides variety and relevance making learning interesting and engaging. Active learning is defined as “Instructor led, student centered, high involvement, practical learning strategies that can be used to help strengthen any learning environment” — Linda Morable, [18].

Learning opportunities for all:

Access to open education resources enables disadvantaged students from remote areas to acquire knowledge and skills required to join the mainstream and participate actively in the knowledge economy. Technologies such as broadcasting through satellite extend the reach of quality education to remote areas where broadband internet access is not available. Rural educational institutes where teachers in special subjects like science are not available can benefit from distance education programs such as EDUSAT.
Strategic Framework:

Strategy involves a process of learning over time in which formulation and implementation start to merge. The strategy shall be aligned with the objectives and make learning affordable to a large audience, while enhancing the quality of learning. Technology enabled learning can help in enhancing the learning experience while being cost-effective. Strategy should help educational institutes and teachers explore the possibilities of transforming the learning experience.

We need to understand more about effective ways of using information and communications technology to enhance the student learning experience. The main objective of our strategy is to enable educational institutes to meet the needs of learners and their own aspirations for development.

Strategic Context:

The knowledge economy:

The knowledge economy with associated increase in complexity and velocity of the work environment brought about by technological changes calls for a paradigm shift in the way education is viewed and delivered. Knowledge economy demands short product development cycle time, knowledge workers with the ability to quickly adapt to the rapid changes in technology and migration towards value chain integration where in knowledge must be shared to contribute ever more value to the system. Educational institutes need a very different knowledge base if they are to prepare young people to make knowledge products, rather than goods. Making knowledge products is about know-how and we need to rely so heavily on learning on accessing, using, changing and rethinking information so that we can come up with a good idea and turn it into an entity even a commercial knowledge product. This is why learning and earning now go together.

ICT in education:

According to the US web-based Education Commission (2000) [17], while technologies may differ in format, their aims are common. They include: more interaction among students or with the instructor; the encouragement of more out-of-class student reflection; and the ability to provide synchronous and asynchronous delivery to deliver learning directly or to ‘store’ it so that learners can access it when required. The same Commission notes that today’s students increasingly expect that their courses will be integrated with online materials or discussions. From the new technologies and the knowledge economy there emerges a new way of learning, which is self directed, informal, just in time, any time, any where, self paced, collaborative and life long. The new technologies shape the new learning and in turn will shape the new education system with by a customised model, which allows individuals to select and make knowledge, which is of interest and value to them — and others. For teachers, these new developments represent huge challenges and the related requirements for professional development are almost incomprehensible.

Strategic Analysis:

SWOT Analysis

Educational institutes should perform an analysis of their own capabilities and limitations as well as the external opportunities and threats. Following that, they should identify the key success factors, which enable them to exploit the opportunities and create value to their students by enhancing the quality of learning.
Strengths
- Existing students
- Experienced teachers
- Accredited curriculum
- Physical presence/location

Weaknesses
- Technology
- Lack of capital/Infrastructure
- Lack of trained faculty
- Poor quality of content

Opportunities
- Enhance the learning experience and student performance
- Increased recognition and image
- National/Global expansion
- Increased student enrollment

Threats
- Attrition of trained faculty
- Fast changing expectations from students and parents
- Rapid changes in Technology
- High cost of training and Infrastructure

Key Success Factors:

E-Learning Curriculum

High quality e-Learning and support materials developed for standard curriculum areas will provide a consistent and enhanced learning environment for students and teachers. We need e-Learning modules that cover the core national/regional curriculum while being flexible enough to allow curriculum responsibility to be delegated down to the educational institute or even the teacher.

E-Learning competencies

Teachers are essential players in promoting quality education and no education reform is likely to succeed without the active participation and ownership of teachers. Clearly defined and more imaginative strategies to identify, attract, train and retain good teachers must be put into place.

These strategies should address the new role of teachers in preparing students for an emerging knowledge-based and technology-driven economy. Teachers must be able to understand diversity in learning styles and create stimulating, participatory learning environments.

E-Learning Infrastructure

A connected infrastructure is a requirement for remote e-Learning. However for online e-Learning, where rich content is downloaded, a high-speed link is important and in some cases essential. The availability and cost of high-speed broadband connections varies widely and coverage tends to be very patchy in rural areas. The important challenge is to increase the availability of inexpensive high-speed connections. Where land-based connections are not available some governments are using satellite links such as Edusat to overcome this barrier.
E-Learning standards

In order to achieve true sophistication in terms of understanding the objectives of a learner and addressing those objectives with a highly customized program of learning, all of the components of a technology-based learning system must be speaking the same language. Accredited standards ensure that the investment in time and intellectual capital could move from one system to the next. The goal of standards is to provide fixed data structures and communication protocols for e-learning objects and cross-system workflows.

Key Elements of Strategy:

Content design:

No one knows exactly what the future holds, but there is little doubt that skilful use of their minds will be an important part of their future. The skilled use of minds would definitely in large part, call for strong basics, a grasp on fundamentals that student takes them forward for a better life. Technology can make learning more interactive, facilitate collaborative learning and enhance the learning experience. The effectiveness of technology enabled learning experience depends on the design of the content and the instructional methods including content structuring and sequencing. In its report, "The Power of the Internet for Learning", The US Commission for Web-based Education [17] identified "the lack of compelling content" as a major constraint on the development of e-learning in educational institutes [17].

The development of learning environments needs to draw upon the knowledge relating to learning theories, learning concepts and models, which open various possibilities and ways of seeing the world. The instructional designer must understand the strengths and weaknesses of each learning theory to optimise their use in appropriate instructional design strategy depending on the learner profile, the subject matter and the educational institute.

Collaboration:

Learning is fundamentally both social and experiential and hence context of the learning including all of the elements that comprise the experience around the content is very important. Collaboration among participants helps them to solve problems, create project plans and design projects in a better way than they would have done individually. Participants can collaborate and help one another reach learning goals by providing feedback, answering questions, and working as a distributed group.

E-learning can support educational institutes working together to raise standards by allowing collaboration between colleagues in different educational institutes, allowing pupils to take special subjects offered by another educational institute without the need to travel. ICT should enable the development of teaching communities that can be used by teachers to share resources, including online libraries, discussion boards, and synchronous communication tools and help teachers to strengthen their curricular and teaching practices in professional collaborations to develop and review teaching materials. Network of teachers working through an Educational institute Net strengthens this form of collaboration.

Access to ICT:

Access refers to the ability to access the information and knowledge with the help of ICT, which facilitates learning anywhere at any time, extending the classroom boundaries and the learning experience.

Broadband facilitates access to creative content such as simulations and game-based learning to explain learning points in interesting, absorbing and imaginative ways and enhance inter-institutional collaboration with sharing of
scarce teacher resources between educational institutes in a high-speed interactive video conferencing to encourage communication and cooperation.

The distance education programs of I.S.R.O. such as EDUSAT are very successful by providing connectivity to remote areas through satellite link.

EDUSAT, India's dedicated education satellite carries the capability of providing audio, video and data services to India through its national and regional beams. This is a satellite operating in Ku band frequency facilitating the use of easy to handle small transmit/receive ground terminal. EDUSAT when it is fully operational in the third phase, it will have the capacity of 30 uplinks and about 5000 remote terminals per uplink.

Technology:

Technology transforms learning experiences by supporting the teaching and learning process with flexibility in terms of where, when, how and what to learn, and who to learn with. Technology plays a very important role in offering learning opportunities, which are relevant, compelling, and collaborative on a continuous basis. We need to use these technologies innovatively to take full advantage of the potential of global access to information, knowledge and experts. Technology can change the curriculum and students’ access to it and increase the ways in which learners can be assessed, so that more students have the opportunity to select the range of media to best demonstrate their knowledge and understanding. Blended learning environment facilitates competency development in learners and provides learning in context across diverse student groups.

Teacher's role in the new paradigm:

Teacher is at the heart of this transformation in learning to facilitate every student to enjoy learning and achieve his/her full potential. The position of the teacher has been elevated and is expected to play a more important role as a facilitator in the development of students. Transformation to the new paradigm is possible through professional training of teachers to acquire competencies in educational technologies.

Teachers can access the rich, shareable, learning objects available from a digital repository and customize them to meet the specific requirements of their students depending on the learner and the context by assembling and packaging them in innovative ways.

Teachers should be assisted by technical support staff to ensure that the networks and equipment are properly installed, operated, updated and maintained. Media production and services staff, such as interface designers, graphics designers, multimedia web designers support the creation and application of educational materials and programs using technology.

Teachers have to develop appropriate competencies to be able to create a learning environment in which he/she designs and enhance the learning experiences and supports learners continuously in achieving their educational goals. Teacher education programs play a very important role in preparing teachers for the new paradigm of learning in which learners are actively involved in the process of knowledge construction and teacher would be a facilitator of knowledge construction.

Strategic Choice Criteria:

Strategic options have to be evaluated and tested for internal and external consistency, feasibility, advantage, value creation, and consonance before selecting the strategy. The role of the teacher at the centre of the learning transformation needs to be recognised and reinforced and teachers must be given every opportunity to enhance their own skills and knowledge in order to create conducive e-learning environments for learners.
Process of Strategic Change:

A successful e-learning strategy includes change strategy also which ensures that all the stakeholders are committed and capable of executing the strategy. The process involves establishing an environment for change, which provides access to adequate resources for all teachers, enabling the support of competent and motivated staff. Knowledge management and professional development of teachers are key factors that can influence change in a significant way.

The process of strategic change includes strategic approaches to development of technological infrastructure, development of technological standards processes and structures that are appropriate for the development and delivery of high quality education supported by technology. Finally strategy implementation should involve collaboration with other educational institutes, other academic institutions and linkages with rich archive of learning materials available as open educational resources and be informed by good practices across the world.

What is the Strategy?

The strategy is to create an environment in which unique value is created for every learner. The learner himself can select and integrate various learning modules to construct knowledge following his own preferred learning style. The teacher can create value for the learners by orchestrating various learning modules through a process of synthesis depending on the learner, content and the context. The value comes from arbitrage of intelligence migration through educational portals and aggregation of learning modules through shared infrastructure and educational resources. Rewiring the network offers learners, varied forms of engagement with different sources of knowledge. Reassembly of the learning modules by the teacher enables learning in context in a way appropriate to the learner and the context [10].

The strategy needs to be simple and flexible to adapt to the fast changing environment of new economy [6], which calls for the new skills to remain relevant in the knowledge age. We should prepare students for life long learning by helping them learn how to learn. So, we need to identify the key strategic processes and simple rules [6, 8] around them that share these processes. Content, technology, access to ICT and collaboration are key elements of the strategy. The right-mix and integration of key elements transforms learning and teaching and prepares students to face the future with confidence and keep smiling. Teacher is at the heart of the strategy and his/her commitment is essential to create and sustain the smile.

The key strategic processes for educational institutes, which create value to learners are empowerment of teachers, engaging content and a motivating learning environment. So for the processes and strategy to be simple, the technology should be simple and easy to implement, content design and development process should be simple, and the learning environment should be simple. Key elements of such a strategy are collaboration, content, access and technology and they need to be integrated in a coherent manner to create and share the SMILE.

SMILE creates conditions for learning in which every student enjoys learning. Learn to learn and learn to share with others there by providing learning opportunities for all. Share the SMILE to learn with smile sums up the strategy to create an environment in which learning is a joyful experience by collaborating to create and share the knowledge.

Share the SMILE:

We have to develop a national network of educational institutes connecting all the educational institutes equipped with appropriate physical infrastructure to facilitate collaboration and sharing of educational resources and the best practices in teaching and learning. This network can leverage the already existing FELisuAT hubs spread all over the country in all the state capitals. A combined network achieves economies of scale in developing e-
learning content and sharing the same with open access. Open source solutions customized for educational institutes can be utilized by all educational institutes through a service oriented architecture. The common infrastructure so developed helps all the educational institutes to offer quality education for all the students at affordable costs.

Strategic Actions:

Networking Educational Institutes with shared resources:

The principle of combined public and private provision of broadband internet access will be fundamental to encouraging access for all. The goal of long-term affordability of universal e-learning is not achievable through the current means of short-term top-slicing and central capital funding. In the longer term, educational institutions will have to take responsibility for e-learning planning and provision within their overall expenditure. For the benefits to be fully realised we must improve resource planning, procurement and collaboration to reduce the costs of e-learning. We must also improve quality, achieve economies of scale and increase value for money. We have to build a National educational institute Network with partnership between, Government, educational institutes and industry with the mission of providing broadband internet access to every teacher and student to enable collaboration between learners, teachers and experts all over the country to share their knowledge and best practices to maximize the knowledge capital and the access to it.

**Strategic actions**

- Educational portals with accredited, appropriate, accessible content
- Networking Educational Institutes with shared resources
- Blended learning with flexible curriculum and assessment
- Center for excellence in educational technologies

**Benefits from Strategy**

- Learning flexibility
- Learning to share and sharing to learn
- New ways of Learning
- Innovation in teaching and learning

Networking of educational institutes through a common infrastructure should adopt a scalable, service-oriented architecture to provide services to educational institutes on a broadband network. EDUSAT program in India offers services over satellite to all rural and remote educational institutes with satellite receivers. This is a cost effective solution to provide access to quality content and experienced teachers in special subjects for all educational institutes. Satellite interactive terminals in classrooms offer live audio-video interaction with experts and students from other educational institutes. Online classrooms can be created to enable classes in one or a number of educational institutes to receive programs from teachers in other educational institutes. These programs may include discussion forums, WebCT and videoconferencing.

**Centre for excellence in educational technologies:**

Centre for excellence in educational technologies dedicated to research in new methods of teaching can train teachers to be more creative and innovative in their teaching. Teachers empowered by technology create an environment and conditions in which students enjoy learning and learn to learn. We should stimulate greater innovation in instruction design and teaching methods to accelerate the development of the next generation of
learning preparing students to face the challenges of knowledge age. The focus should be on design flexibility for teachers and engaging activity for learners. We also need research to map out future directions. This research should reflect how teachers teach and learners learn. As we research and develop more innovative pedagogical methods, we should look for ways to deliver them more effectively through e-learning.

Centre for excellence in educational technologies is required to train teachers in information and communication technologies to enable them to utilize e-learning technologies for developing content anchored in instruction design with good pedagogy in creative and innovative ways. We can achieve innovation in teaching only by supporting teachers to share their knowledge and methods of teaching to evolve best practices and interesting ways of teaching. Teachers need to be able to find, access, create, use and adapt the resources they require to build lessons that will suit their teaching methods and the learning styles of their learners with a common approach to technical, pedagogical and quality standards.

Technology and training will allow educationalists to deliver learning riches that would not have been possible earlier. The solution will be the emergence of well resourced and savvy teachers, whose understanding and creative use of technology helps them achieve undreamed of levels of excellence for themselves and for their students. In the new knowledge society. it is often said that there can be no more exciting or significant profession than that of teaching. Education is now central to the prosperity of society and teachers can be among the most important of the professionals.

Educational portals with accredited, appropriate, accessible content:

Educational portals like MIT ‘OpenCourseWare’ with engaging and motivating content in the form of learning modules will be helpful to teachers for use in their class rooms. Educational institutes can share their own online programs with the involvement of students and collaboration with other educational institutes in similar projects. Teachers are not professional digital content producers - although they can improvise - so they need access to a rich digital library - to a digital repository full of world class learning objects which they can point to, package, present to their students, who will use the content to make their own knowledge products. e-learning content includes curricula on-line, such as the courses recommended by board of education or government to very small objects, such as graphics or animations, that can be accessed over the Web and downloaded for use in a particular piece of teaching. We also need to focus on development of standards to assure the pedagogic quality of e-learning provision, and mechanisms for monitoring and updating the standard in the light of changing technologies and access requirements.

Education for all therefore requires access with equity and equality to ensure that the quality of learning each student receives is the same. The most promising innovation is the concept of open educational resources (OERS). The concept of open educational resources (OER) refers to open course content, open source software and tools. Open educational resources apply to teaching and learning the basic principle of sharing that underpins academic research. Distance educators have talked for years about sharing courseware. Open educational resources made possible the sharing and adaptation of courseware on a more equal basis. Re-usable learning objects are the equivalent of the published articles on which subsequent researchers can build. Government, experts, teachers, learners, universities, educational institutes, nongovernmental organizations, private initiatives like BBC and MIT can successfully combine connectivity and shared courseware to develop a global archive of e-learning materials which can be shared on an equal basis. e-Learning, with Free Open Source Software and Open Educational Resources, give us the chance to do that.

Blended learning with flexible curriculum and assessment:

Blended learning leverages technology to assist teachers in creating an environment in which teachers and learners enrich the learning process with technology assisted knowledge construction and sharing through interactive forums.
Flexible curriculum and assessment:

NCF recommend softening of subject boundaries so that students get a taste of integrated knowledge and the joy of understanding. Educational institutes must provide opportunities to question, enquire, debate, reflect, and arrive at concepts or create new ideas. An element of challenge is critical for the process of active engagement and learning various concepts, skills and positions through the process. Blended learning enables students to seek knowledge beyond the textbook with access to enriching content with multitude of perspectives and ideas.

The purpose of assessment is necessarily to improve the teaching-learning process and materials, provide learners with feedback, and set standards for them to strive towards. Tests in knowledge-based subject areas must be able to gauge what students have learnt, and their ability to use this knowledge for problem solving and application in the real world.

Open-book exams and exams without time limit, online self assessment supported by worked out examples ensure that students acquire problem solving skills and become confident. Assessment needs to become more open, flexible, creative and user friendly. All subjects could be offered at two levels with students doing at least three/two of the six at standard level and the remaining three/four at higher level. Blended learning with online assessment makes it possible to present a wider range of performance parameters and flexible assessment.

Benefits of SMILE Strategy:

Learning Flexibility:

Students find more ways to develop the skills they need to participate fully in a technology-rich knowledge society. e-learning achieves economies of scale through wide access to digital resources and information systems, combined with quality through shared tools and resources. Students will have more choice about where, when and how to study, learning through engaging, versatile and challenging activities and materials that adjust to the level and pace appropriate to them.

New ways of Learning:

New technologies enable new ways of learning which blends traditional classroom learning with self directed as well as networked collaborative learning. Explaining concepts to students through text and static images in a book can cause difficulties particularly when the concepts are dynamic. Simulations allow variables to be changed so that students can understand cause and effect and the need to control variables in any experiment. The new technologies shape the new learning and in turn will shape the new education system. The focus shifts from content to competency, from what is known to what use you can make of the information. from what teachers can teach to what learners can learn. We need the customizing capacity of the online medium that allows individuals to select and make knowledge, which is of interest and value to them and others.

Learning to share and sharing to learn:

The collaborative e-learning brings learners, teachers, specialist communities and experts together to share ideas and good practice, contributing to new knowledge and learning. Collaborative online environments helps students to learn from other students or groups of learners as well as tutors and develop the cognitive and social skills of communicating and collaborating.

Innovation in teaching and learning:

e-learning offers a wide range of design tools to enable teachers and learners to be innovative, and creative by explaining difficult concepts through animations and simulations. Teachers can access the digital content
available online and modify or adapt the same in innovative ways appropriate to the context and the learner to make learning enjoyable.

Conclusions:

Learning environment plays an important role in transforming learning and helping students develop curiosity and enjoy learning. Students learn how to learn and apply what they learned in new situations to find innovative solutions. SMILE (simple, motivating, interactive, learner centric environment) enable students learn with smile and we need a strategic approach to create such a learning environment. Key elements of such a strategy are content, technology, access and collaboration and teacher is at the heart of the strategy to develop a vision and realize it.

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