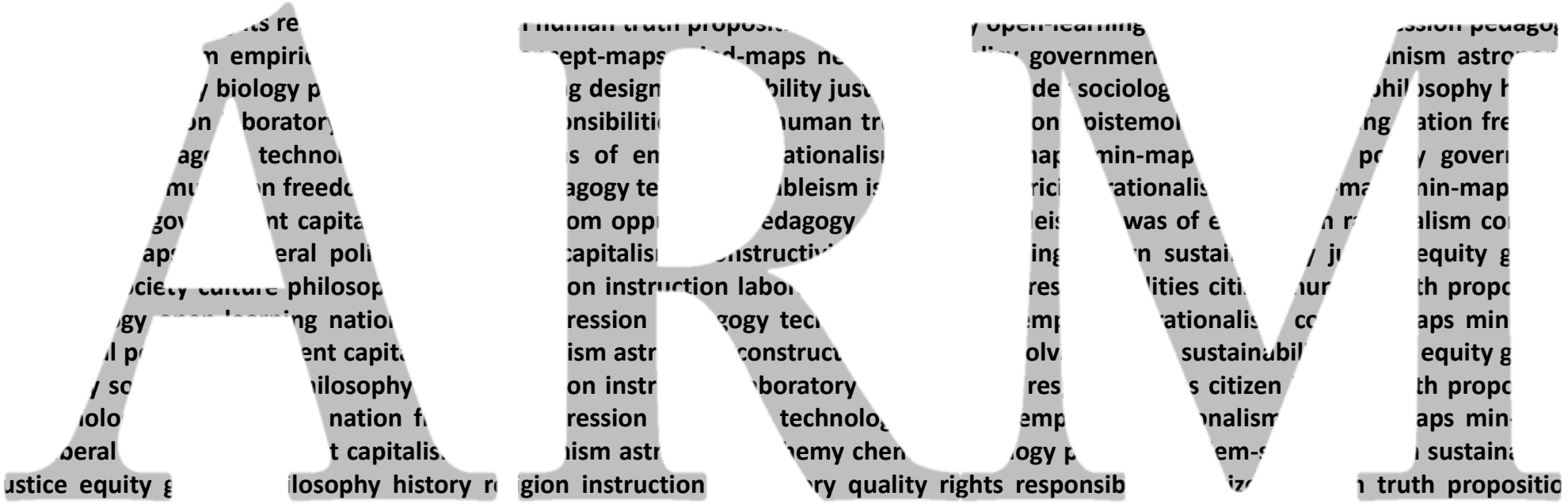

ABSTRACT BOOK

2014

Homi Bhabha Center for Science Education

FOREWORD

The Annual Research Meet is conceived to be a kind of retreat which enables pleasant yet intense academic interactions among students and faculty. Its objective is to create and maintain a vigorous collaborative research ambience at IIBCSE.

The first Annual Research Meet at IIBCSE was held on February 11-13, 2010. In 2011 and 2012, it was held in April: 19-21 April in 2011 and 17-19 April in 2012. As the engagement needed in the ARM was conflicting with the end of semester submissions in April, the meeting was moved to September 23-25 in 2013. This year, the convenient dates of 14 to 16 October 2014 were decided through a poll. However, with 15 October being declared a poll date for the Vidhan Sabha elections of Maharashtra State, and the last minute preparations for the IIBCSE Review, the ARM has been moved a month away . It will be held from November 12 to 14, 2014.

ARM features presentations and talks by Ph.D. students in their 2nd Year onwards. It is organised by the first year students. As the first year students this year have no experience of the programme, the ARM organising committee included a couple of senior students as well.

The event is organised in the following way:

- *After the event dates are finalised, and important dates in the run up to the event are announced, students first submit abstracts to indicate intent to present.*
- *Soon after, presenters suggest faculty discussants for their presentation, and initiate a dialogue with discussants to schedule their submission.*
- *All presenters must send their final abstracts well in time to be included in the abstract booklet.*
- *Presenters arrange to provide a draft paper/ write-up to their discussants well in advance. This write-up may be a draft of a research publication (or leading towards a publication). In some cases students who have recently published research may present that work. It may also be work-in-progress, indicating clearly what aspects of analysis or discussions are yet to be completed.*
- *The student's write-up is read by the discussant before the presentation, and comments and suggestions are given by the discussant after the student's presentation.*

Continued....

The event can and should evolve in format, including scheduling, primarily through the active engagement of the research students, and other members of the research community at IIBCSE.

I thank the ARM Coordinating Committee, Deborah Dutta, Dugra Prasad, Stephen Philip, Subhayan Kabir, Kanchan Mishra, and the senior students, Shikha Takker and Prajakt Pande for enthusiastically meeting the challenges of organising the event. That 11 research students will be presenting at ARM 2014, even though some felt highly pressured by other commitments, is an indication that the event is valued by the students. The ARM Coordinating Committee members and I are grateful to all the students and other academic and scientific members for their cooperation.

A big "thank you" to all our colleagues who have supported the event and helped to bring seriousness and rigour to research at IIBCSE. Look forward to ARM 2014, the academic festival for the students and of the students of IIBCSE.

Chitra Natarajan
Dean, IIBCSE Faculty

CONTENT

THEME-1 :STUDENT IN FOCUS

THEME- 2 : TEACHER IN FOCUS TALKS

THEME- 3 : DESIGN AND TECHNOLOGY

Action based analysis of students' strategies

Coming from my broader research interest of understanding students' conception of area measurement, here I am reporting an experimental study investigating how manipulation of physical objects improve students' understanding of area. Students had to solve two area tasks, and then answer some questions about the way they solved the problems. Participants were randomly assigned to one of two groups: an experimental group that did a manipulation task (similar to tangram) before attempting the area task, and a control group that got a general knowledge questionnaire before the area task.

Three types of data were collected, data on student actions (based on video), self-reports of strategies used (based on interviews), and eye-movement data (from an eye-tracker). Here I report an analysis of the video data and interview data, as well as an analysis of the eye-tracker data. In the video data analysis, strategies were identified based on students' actions. The strategies identified from this analysis were compared against self-reported strategies. For the eye-tracker data, eye-movement trajectories across the task were analysed.

Both the video and the eye movement analysis shows clear differences between the groups in terms of the process of solving the problem. Further, the eye tracker data showed details of strategies that were not available in the video analysis, but were reported by students.

I discuss implications of this result for the teaching/learning of area, and future studies that are planned to more clearly understand the way physical manipulation of objects support the understanding of area.

Jeenath Rahaman

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Guide : K Subramaniam
Discussant: K Subramaniam & J Ramadas

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Keywords- area-measurement, manipulation, student's strategy, eye-movement

Question generation by students in science classrooms

The importance of students' questions has been recognised by science educators, however, very few studies have been conducted to look at students' questions in situations, where they have complete autonomy to come up with questions. To understand this, we conducted an open-beginninged teaching workshop with middle school students. In the workshop students came up with their own questions upon observing a plant with variegated leaves (a variety of bhendi (Taliparíti tiliaceum)) and later tried to answer their questions by developing methods of investigation. The workshop was divided into five parts: (i) question generation by students, (ii) listing and sorting of questions, (iii) developing a method of investigation to answer a chosen question, (iv) carrying out the investigation and (v) sharing work with other students.

In this study, we are presenting our analyses of question generation by the students in situations where the discourse is initiated by students under a context provided by the teacher. Teachers intentionally kept quite initially, so that the students could have more autonomy and, hopefully come up with questions on their own. Data sources are in form of audio and video recordings, researcher's notes, students' writings and semi-structured interviews of students. Two important observations emerged from the study, one that students tended to make statements initially rather than ask questions, and second that students' questions changed from information to investigatory type as they designed and carried out investigations.

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Keywords : open-beginninged, variegated leaves, students' questions, student initiation

Building theory on ableism & disability oppression

Ableism is a network of beliefs and practices that constructs and projects a particular kind of body as the normal, species-typical and therefore essential and fully human. In school mathematics, the curriculum is presented, taught and even defined in terms of the visual which is from the point of view of sighted individuals. This ableist practice shapes the structure of mathematics education which in turn shapes practice.

I argue that mathematics is not inherently visual but being taught and defined in terms of the visual, is ableist (and thus, oppressive) and an outcome of a lack of understanding of mathematics. In some cases its also the desire to maintain an oppressive status quo.

Research in education focusing on disability is dominated by a liberal (and instrumental) approach which works towards maintaining the normative (ableist) structure by presenting mathematics as naturally visual. The research outcomes being humanitarian rather than humanist work as charitable donations or tokens of false generosity for temporarily overcoming an ableist hurdle. It works neither towards enabling students to be autonomous learners nor towards empowering them to transform the world. Assuming an individual model of disability, it constructs a visually impaired individual as deficient and reinforces a disabled consciousness when s/he engages with mathematics and denies the student the experience of construction and ownership of mathematical knowledge. Through my field observations, I argue for an expanded understanding of mathematics not just for social justice but also for justice towards the discipline of mathematics.

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Keywords- ableism, math education, disability, social justice

Understanding the age/class appropriateness of the students to internalize the various phases of inquiry effectively

Sujatha Varadarajan

Discussant: G Nagarjuna

Inquiry, the widely accepted mode of learning science, is recommended by NCF. There is nationwide urge to implement this pursuit of science education in the schools all over. If science classroom continues to provide information, facts and definitions, the techniques of memorization alone would be nurtured. The real science would soon lose its appeal amongst the students. What could be the alternative such that the students can be trained to think like scientists? Inquiry based learning (IBL) provides an answer. IBL furnishes them a chance to develop their own understanding of the intriguing things around them. To make a mark in the field of scientific research and development, the current rote methods have to take a back seat bringing forth the IBL as the effective way of dealing science.

Although inquiry offers compelling opportunities for science learning, data gathering, analysis, interpretation, and communication are all challenging tasks that are made more difficult by the need for content-area knowledge (Gardner and Peavy).Age of students could also be one of the factors posing impedance in successful implementation of IBL.The research question is, what is the appropriate age to introduce the strands of experimental inquiry? The present study aims to investigate the age appropriateness for introducing the strands of inquiry.

Students of class 6th, 7th, 8th of a CBSE School and a State Board School in Pune were involved in this study. The different inquiry strands namely, observing minute details, raising interesting questions, identifying the correlating factors and constructing hypothesis, were introduced to the students through classroom discussion. This was followed by a demo of activities/experiments that were carefully designed to trigger different strands of inquiry. Following this, assessment tasks were given. The presentation would highlight the inquiry triggers and class wise response of the students to the inquiry task assessment.

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Keywords : inquiry, classroom learning

Implementation of "KOHA: Free open source Library Management software" in HBCSE library from November 2014

D.D. Pednekar

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Library and Information centres are experiencing a huge transition from printed to digital collection. This has led to many changes in the traditional library practices as well as role of library and information professionals who facilitate access to and dissemination of information.

The HBCSE library and information personnel are actively exploring new ways of optimizing access to electronic resources. HBCSE library has taken the initiative to shift from the commercial library management system "Librarian 5.6" to the open source software "KOHA", which is based on international open standards. KOHA satisfies all the functional requirements of a library management system. It is a free open source software and does not need any initial cost like other commercial softwares. KOHA provides a full functional Online Public Access Catalog (OPAC) which has various features that allow:

- Users accounts on OPAC
- Search of the library catalogue from any site
- Keyword and advanced searching
- Virtual shelf browser
- Access to personal account information
- Make purchase suggestions
- Making private or public lists of specific collections

Off all the TIFR centres and the main campus, HBCSE is the first institute to move its library functions to KOHA open source library management software. The presentation will highlight the features of KOHA and the new version of OPAC.

Keywords : **library, free software**

My Experiences about 25th AABE Conference

Narendra Deshmukh

HBCSE, TIFR

Many national and international academic associations are playing a crucial role in providing a platform to the teachers, educators, researchers, environmentalists, policy makers & administrators, for sharing best practices and experiences. These associations are also helping to create awareness among teachers and students about various social, environmental and global issues. Since 2009, I am associated with the Asian Association for Biology Education i.e. AABE. The first AABE conference was organised in 1966 at Manila, Philippines and its main office is at Philippines.

This year the 25th AABE conference was organised by University of Malaya, Kuala Lumpur, Malaysia, from Oct. 13-16, 2014. The main theme of the conference was "Biology Education and Research in a Changing Planet".

More than 250 participants from various countries participated in this conference. Apart from Key note addresses by eminent biologists, there were oral and poster presentations, workshops for teachers and excursion tour for conference participants. In this conference Executive Committee has decided that 26th AABE will be organized at Goa, India. A detailed report of 25th AABE and papers (Why do school students' have misconceptions about life processes and Use of technology in classroom for implementing remedial module to overcome school students' misconceptions) presented by me will be discussed during the presentation.

Keywords : AABE, conference, experience

Analysing Links in Concept Maps : A Conceptual Change Approach

Conceptual change has been widely and significantly studied as a paradigm for science learning in science education research. Largely influenced by the history of science, conceptual change research has branched into several specific kinds. These include addition, deletion, enrichment, re-structuring, progressive differentiation, subsumption, fragmentation, gradual, punctuated model, re-organizing, re-classifying, categorical shift, etc. During the course of cognitive development, learning takes place by changes in knowledge structure or cognitive structure. Conceptual change depicts the changes in the structure of knowledge, the basic elements of knowledge being concepts (nodes) and relations (links). Much of the focus so far has been on the change in the concepts per se. However, switching the focus from concepts to links, the present study highlights change in links, and its various characteristics.

The work presented focuses on mapping of school biology textbook, experts' textbooks, and students' biology knowledge in the form of propositions comprising of concepts and relations. The propositions are validated for semantically accurate linking words. The re-represented text indicates changes occurring in the linking words that can be categorized as categorical shift, re-organization, deletion, coalescence, and differentiation.

Meena Kharatmal

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Discussant: Prof. Jayashree Ramadas

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Keywords : conceptual change, concept mapping, linking words, biology education

Exploring the ecology economy discourse in high school science

Contemporary socio-political context is characterized by neoliberal economic forces, numerous forms of inequality, continuous denial of justice to poor and other marginalized section of society, the state-corporate alliance and so on. There has been and there is a parallel culture of dissent and continuous struggle for rights as well. Education in this context can play an important role. It can be used either as an instrument to socialize younger generation to conform to the norms and maintain the status-quo or to question the logic of the existing system and participate in the transformation of the world to a more equal and just space. Realizing the extent of social divide and injustice prevailing in society, educationists like Paulo Friere and Henry Giroux have argued for transformative education. The study I present here is motivated by these arguments. Similar concerns have been raised by some science educationists like Aikenhead, Hodson, Santos and others as well who have adopted a humanistic approach toward science education. These scholars advocate for inculcating 'critical scientific literacy' and prepare students for taking socio-political action. The paper begins with an analysis of important policy documents in education to understand what perspective these documents hold on the concerns raised above. In order to understand how these concerns have been realized in secondary science curriculum, the nature of discourse around development, environment and its relationship with science and technology is discussed at length. This analysis is based on the data collected during my fieldwork in which I interacted with three science teachers, observed their classes and analysed relevant chapters from their textbooks. The analytical framework draws from the literature on environmental politics, particularly the debates around the ecology-economy conflict, the idea of balance in nature, sustainable development and structural issues like industrial capitalism.

Himanshu Srivastava

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Keywords : transformative education, critical scientific literacy, socio-scientific issues, science and development, ecology economy, secondary science curriculum

Investigating Teachers' Engagement with Mathematical Practices
A Study of Mathematics Teachers' Problem Solving

This paper repots on an analysis of teachers' engagement in a problem-solving workshop. The study, which is part of a larger study designed with an intent to investigate teachers' use of mathematical practices in relation to teaching mathematics, reports narratives of teachers(i) engagement in a mathematical practice, namely, "making and using special cases", during a problem-solving workshop.

Many educators have studied the problem of teacher knowledge since Shulman(ii) argued for the specialized content knowledge for teaching. Researchers have been attempting to elicit what constitutes the knowledge required to teach mathematics, by analysing knowledge demands, in teaching with understanding and in other works of teaching (like planning, evaluating, etc.). Although, some ideas of what constitutes knowledge for teaching mathematics does exist, almost no understanding is available of what practices of doing mathematics are needed to teach reform mathematics (iii).

Ball and Bass(iv) report that teachers often miss mathematical opportunities in the class as they lack mathematical sensibilities and knowledge of fundamental mathematical practices. In this study, teachers are exposed to certain mathematical practices used in solving problems. The author contends that, teachers' engagement in particular, focuses on using the practice differently at different stages of the problem solving. Moreover, even though, teachers did not reach for the answer, as what is understood traditionally, they considered the problem being solved once they gained insight into how the solution would look like. The study indicates that, doingmathematics, in the way it is suggested in the reform, requires supportive tools such as knowledge of mathematical practices, as it enables exploring mathematics in the problem rather just its Solution.

i) Total 34 participants, prospective mathematics teachers worked in groups of 5-6.

ii) Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. Harvard educational review, 57(1), 1-23.

iii) Naik (2014). Investigating teachers' mathematical thinking: Examining the role of mathematical knowledge and practices. Dissertation proposal.

iv) Ball, D. L., & Bass, H. (2002). Toward a practice-based theory of mathematical knowledge for teaching. In Proceedings of the 2002 annual meeting of the Canadian Mathematics Education Study Group (pp. 3-14).

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Keywords- mathematics teaching, student understanding, teaching practices

Using Activity Theory to Investigate and Assess Student Drawing in Learning Science

Karen Haydock

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Building upon the work of Richard Duschl & Drew Gitomer (2014) and Margaret Brooks (2002), I have investigated how formative assessment of student construction of 2-dimentional visual representations can be used in learning science. Using an activity theory framework (Wolf-Michael Roth et al, 2009), I will present an example of how micro-analysis of student drawing can be used to understand the cognitive basis of learning that may occur in the process of drawing.*

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- Margaret Brooks (2002), Drawing to Learn, Unpublished PhDthesis, University of Alberta, Canada
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Keywords : visual representation,, student drawing, learning science

Characterising teaching practice with a focus on student's thinking: A Case Study

Teaching is a complex activity and understanding teaching practice poses several challenges to researchers. Characterising teaching practice has been done through interviews with teachers (Ma, 1999) and asking teachers to respond to questions around classroom teaching and students' thinking (Hill, Schilling, & Ball, 2011 ; Philip & Sowder, 2004). More recently, there has been a focus on student's mathematical thinking to promote teacher learning (CGI and work on student cases). However, in many programs, teachers are considered to be the implementers of the research-based knowledge on students' thinking. In the current study we are attempting to characterise teacher's practice through in situ observations of teaching and identifying artefacts from the site to organise teacher learning. In this presentation, I will discuss the process of development of a coding scheme to analyse data from classroom observations, collected at the beginning phase of my research. Further, I will present preliminary observations about patterns in teaching and insights it offered to support the planning of the next phase of working on creating a learning environment for teachers.

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Keywords- mathematics teaching, student understanding, teaching practices

A Proposal to Extend Concept Mapping to Concept Lattices for Representing Biology

Textbook biology knowledge is being represented as triples using concept maps. These triples can be extended to create concept lattices by representing objects and attributes in relation. By focusing on the nature of semantic relations, concept neighbourhood lattices can be generated for dependencies, associations. By representing the changes in the attributes of objects in time, concept lattices of dynamic propositions can be generated. As the knowledge base for the study is textbook biology, this research on using concept lattices in school, college biology education can be further developed with focusing on teaching learning, cognitive assessment.

The presentation will provide an overview of the Summer School on – "Methodology of Task Design – How to Create Exercises for Learning", held in Technische Universität, Dresden, Germany. The summer school was targeted on designing learning tasks, and creating exercises for learning. I will talk about the proposal and share some experiences of the summer school, and the place.

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Keywords : concept mapping, concept lattice, biology education, knowledge representation, summer school

Chalopede: a multi-legged walking mechanism -*how do Mechanical Engineering students learn when they build, applying theoretical design knowledge.*

Ram Rao

Supervisor: Nagarjuna G

Chalopede is a term coined to describe a load-carrying trailed vehicle which uses multi-jointed legs instead of wheels, to traverse uneven surfaces. It is a multi-legged walking structure expected to carry a certain payload.

The research motivation was to understand the process by which engineering students apply their theoretical and formal design knowledge in a Project-based learning situation. The plan was to work with and observe a team of final year mechanical engineering students, who worked on designing and prototyping this machine as part of their internship with the Homi Bhabha Centre for Science Education.

The *Chalopede* project derived inspiration from the wind-propelled kinetic sculptures innovated by Dutch artist-engineer: Theo Jansen of Ypenberg, the Netherlands. One possibility for the 2*n-legged passive walker was to experiment with crank-based leg linkages similar to Theo Jansen's Strandbeest. In the first phase, the students were to produce a trailed vehicle capable of carrying a 50 kg. payload, using Theo Jansen's crank-based leg linkages, over terrain too rough for wheeled vehicles.

The objective was to monitor design changes, through the evolution of the project and the learning that ensued. The project team was studied in the Preliminary Stage, Middle Stage and End Stage of the project. The study examined their initial knowledge and intra-curricular and extra-curricular, sources of knowledge. Changes in design and rationale for those changes were studied, as was the evolution of the mode of representation of the design.

A case study approach was used. The work of the students, including their evolving design was studied in three snapshots during the construction and design of *Chalopede*. It was planned to evaluate student learning through the project by having weekly discussions with the students and assessing progress of the prototypes, taking photographs and conducting semi-structured interviews, with the intent of eliciting a documentary of progress and learning.

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Keywords- problem-based learning, engineering, *chalopede*

Chat Studio: learning arithmetic in social-virtual environment

Rafikh Shaikh

Guide: G Nagarjuna

Virtual chat room in a technology aided classroom allows student to communicate in writing, which aids their literacy skills, as well as helps situate themselves in a social environment. In virtual chat rooms, when one student writes, the content is immediately available to everyone. In other words, it is part of students' memory to which other students have access. We call it shared mental space.

Does shared mental space plays any role in learning? To explore this question we have designed an experiment with a control group and an experimental group and chose arithmetic as a topic. Both groups work with applications designed for them. Control group engage with an activity where students have to play number game with computer and experimental group engage with an activity where a student has to play with other students. Both activity record students' performance on daily basis in computer logs.

42 students (15 female and 27 male) from a Marathi medium Government school in Mumbai are participating in our on-going study. Present talk will be about current status of the same.

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Keywords : **arithmetic, ICT, communication**

How does representational competence develop? Explorations using a fully controllable interface and eye-tracking

Representational competence (RC), defined as "the ability to simultaneously process and integrate multiple external representations (MERs) in a domain", is a marker of expertise in science and engineering. However, the cognitive mechanisms underlying this ability and its development in learners, is poorly understood. In this paper, we report a fully manipulable interface, designed to help school students develop RC, and a pilot eye and mouse tracking study, which sought to develop a detailed understanding of how students interacted with our interface. We developed an analysis methodology for eye and mouse tracking data that characterizes the interaction process in analytical terms, and operationalizes the process of MER integration. We present preliminary results of applying our analysis methodology to student data obtained in our pilot study.

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Keywords: multiple external representations, representational competence, distributed cognition, embodied cognition, equations, graphs

Categorization of multiple external representations by chemistry undergrads: an eye-tracking study

Multiple external representations (MERs) are crucial in the learning and practice of chemistry. Representational competence (RC), the ability to simultaneously process, integrate and transform between MERs, marks expertise in chemistry. Student difficulties in learning chemistry are often attributed to problems in simultaneously processing and integrating MERs, such as equations, graphs, reaction mechanisms, and molecular structures. Johnstone's model of three thinking levels describes three different levels of representations in chemistry (symbolic equations, molecular models and reaction phenomena). Supplementing this model with Baddeley's model of working memory, Johnstone attributes student difficulties to the way the thinking levels interact with the limited capacity of human working memory. Explanations, for student difficulties and expert-novice differences, inspired by Johnstone's accounts, range from problems with working memory (students have less working memory skills), context and practice (students lack exposure to these) and conceptual understanding (students have superficial understanding). In contrast to this classical information processing framework, our approach seeks to understand the cognitive mechanisms underlying the processing of MERs, using recent cognitive theories such as distributed and embodied cognition. In this paper, we report the gaze patterns and grouping strategies of six chemistry undergrads, during an MER categorization task. The students were presented with 3D molecular animations (depicting only molecular level reaction dynamics, without symbols and text), graphs, chemical equations and videos of certain chemical reactions, and were asked to categorize the given MERs. Eye-tracking was used to obtain fine-grained data about students' gaze and eye movement patterns while they viewed these representations.

Students have difficulties in chemically relating animations to other representations such as graphs and equations. They tend to focus on surface features, and ignore any cues relating to dynamics of the reactions, in both static (such as graph) and dynamic (such as animation) MERs. Integrating molecular dynamics with equations and graphs requires generating dynamic features using static equations and graphs. Imagination of dynamics, and the cognitive mechanisms underlying such imagination, seem critical to RC in chemistry.

Prajakt Pande,

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Keywords: representational competence (RC), multiple external representations (MERs), chemistry education, molecular animations, categorization, eye-tracking

Exploring attitudes of students, parents and teachers towards inclusive education

Attitudes towards inclusive education have been recognised as important since these can be a barrier to equal education of people in India (UNESCO, 2010). Studies have shown that positive attitudes of teachers affect inclusion (Changpinit, et. al, 2007), and that inclusive education develops positive attitudes in teachers towards inclusion (Reusen, Shoho & Barker, 2001 and Subban & Sharma, 2006). This study aims at understanding attitudes of students, parents, teachers and principals towards the "inclusion" of students with disabilities (SWD) in regular classes.

For this purpose, a scale was adapted based on the Attitude Towards Inclusive Education Scale developed by Wilczenski's (ATIES, 1993). This adapted scale was used to collect responses from 7 Principals, 97 teachers, 166 parents and 522 students from 10 different schools. Further, qualitative interviews of 3 teachers, 3 students, and 2 parents were conducted to explore their attitudes to inclusion in classrooms.

With respect to inclusion of SWD in regular classes, all the categories of participants were positive towards inclusion of students with physical disabilities in regular classes. Parents and teachers were negative to the inclusion of students with sensory disabilities, related to vision, speech and hearing. Significant differences were found among students from different types of schools namely special, inclusive and general (students from inclusive schools having significantly more positive attitudes as compared to others). This finding is in accord with Olaleye et al. (2012). Significant differences were also found in the attitudes of teachers with experience of teaching SWD (who were more positive towards inclusion of SWD) as compared to teachers without experience of teaching SWD. Teachers also emphasised the need for additional support in managing classes with SWD. The availability of such support in classrooms would benefit both students and teachers. The presentation will include details of the findings of the quantitative as well as qualitative study.

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Keywords : **students with disabilities, inclusion, attitudes**

Visuospatial Learning in School Science

Research in science education has developed over the last 50 years as a highly interdisciplinary enterprise, at the same time richly connected with the practice of science as well as of education. I will illustrate research at the Homi Bhabha Centre for Science Education using the example of visuospatial learning and reasoning in school science. Visuospatial challenges for thinking occur at very large and very small scales. Elementary astronomy and DNA structure are two such vastly different domains of school science where, surprisingly at first sight, similar cognitive issues are seen to occur and similar pedagogical tools are found effective. I will give a broad overview of these results.

Research in science education is needed in order to provide a reasoned basis for designing science education: be it new curricula, textbooks, lab courses or teaching methods. This research requires one to have a background in basic science, with an interest to explore cognitive and socio-cultural issues in education. Illustrating such research as above, I will broach the possibility of "science education" as a career option for young scientists.

Jayashree Ramadas

Professor of science education and Centre Director of the HBCSE, TIFR, India. She has an M.Sc. in Physics from the Indian Institute of Technology, Kanpur, 1976, and a Ph.D. in Science Education from HBCSE, 1981.

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Keywords : science education, research, visuospatial learning