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CONTENTS

FUNDAMENTAL DUTIES OF INDIAN CITIZEN

2 To abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

2 To cherish and follow the noble ideals which inspired our national struggle for freedom;

2 To uphold and protect the sovereignty, unity and integrity of India;

2 To defend the country and render national service when called upon to do so;

2 To promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

2 To value and preserve the rich heritage of our composite culture;

2 To protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures;

2 To develop the scientific temper, humanism and the spirit of inquiry and reform;

2 To safeguard public property and to abjure violence;

2 To strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavor and achievement.

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An Example of a Creative Approach to the Teaching of Chemistry

Paolo Patrizio*, Eva Muja & Ivan Vito Ferrari*****

ABSTRACT

Chemistry is a subject that students meet during scientific course in high school and in the University in scientific faculty. It is generally accepeted that Chemistry needs more logical level of learning and require a good level of teaching. In this article is reported an example in which way is possible to promote the Chemistry subjects with a creative approach.

Key words: Periodic Table, Elements, Quality of teaching.

Introduction

Quality of teaching is very important today. We have described here a new creative example of how to ease the teaching of chemistry. Quality of teaching. A lot agree that it is an issue of methods, style of teaching, with special attention to the Prof or to the students or both. In the last few years, for different reasons, we are losing our capacity for discrimination, our capacity for teaching. In recent years, for various reasons, the ability to learn has been lost and, therefore, with results that lead to non-optimal training of students. Nowadays, one can more or less agree, but training is always a fundamental pillar to facilitate students' entry into the world of work. Even if we then know that, unfortunately, clientele relationships are found in all companies and in all countries, but in any case, the training combined with the skills and commitment on the part of the students and with intelligence, the best students always manage to get what they want, even sometimes at different levels of society, but they can always say that they have succeeded on their own in obtaining any results, on the other hand in an individualistic society this could be a strong message to students to be stimulated to improve and enter in the world of work.After all, fighting is part of life. And it seems to me that everyone has to overcome major challenges in order to assert themselves. Therefore, training must be part of the concept of providing students with the right weapons to face their lives, maintaining their values. After all, what does it mean to teach? Isn't it perhaps the ability to transmit knowledge, the

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light that opens the doors to the outside world, and don't we all agree on the importance of teaching in such a vision? Teaching is perhaps the most beautiful job one can do and this emotion arises from those teachers who love to teach and see their roles as a mission. In this work I have simply reported a teaching example method applied to learning the elements of the periodic table with a creative approach. Who knows, maybe this simple method could be included in chemistry textbooks as a mark of my imprint. I would have succeeded in my purposes. The first didactic, and the second a permanent historical imprint of this lesson. Let us remember that a value for teachers is represented by how capable they are of transmitting their knowledge and to what extent their knowledge has remained imprinted in the minds of the students. In the end, the critical spirit is the spirit that is needed in everyday life to be able to face the problems that are normally encountered in life. All over the world, we know the importance of chemistry in today's world and, statistically, most students find this discipline quite difficult to learn. In this work he offers a simple gimmick for remembering the periodic table of elements, which is the basis of knowledge of nomenclature and chemical reactions.

Materials and Methods

With the sample sentence "Chemistry makes investigation on how to Parking molecules-Zoo, into the matter like does God for human beings in the Earth-Space box." it is possible to remember all elements in the periodic table of elements. So all letter are "CHEMISTRYAKNVGOWPLZDFBX".

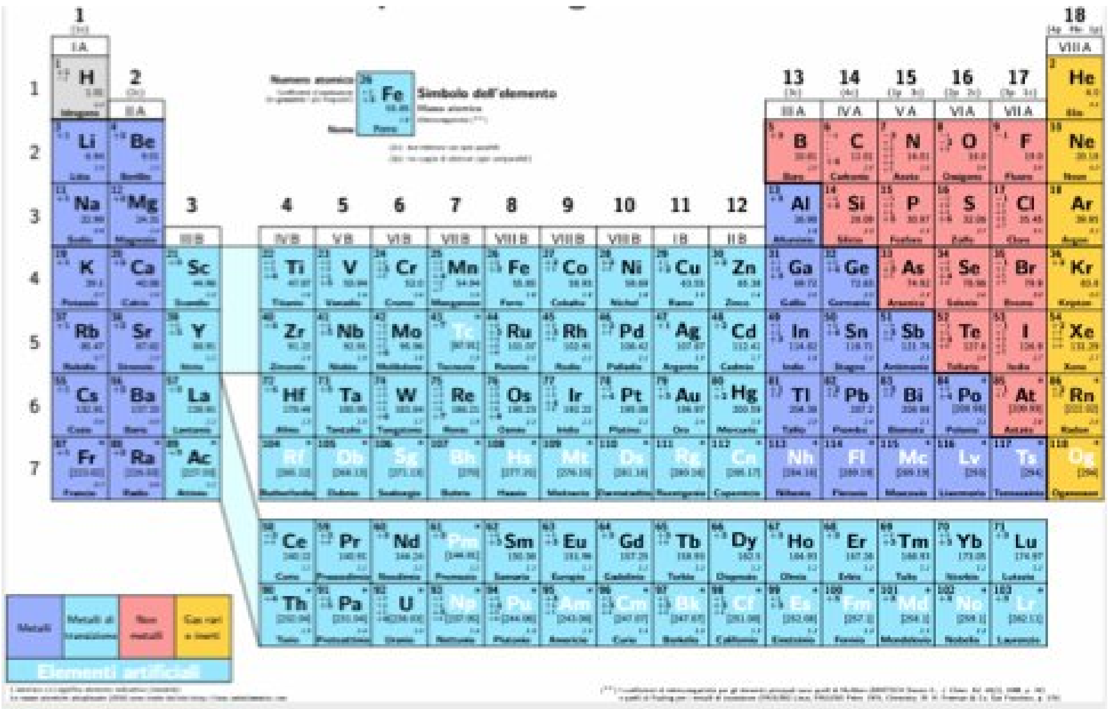
The working mechanism is very simple. Just take one of the red letters of the sentence and combine it with another lowercase letter, like in this example, Ca, Calcium, Co, Cobaltum...S sulfur and Si Silicium and so on. You can use the capital letter of the symbol of elements alone or add a lower case letter to form all of the elements possible present in the periodic table. Take the letter W and obtain tungsten Y yttrium, Y add b, Yb ytterbium, and the less known from Z=104-118 as follow: Rf Rutherfordium, Db Dubnium, Sg seaborgium, Bh Bohrium, Hs hassium, Mt Meitnerium, Ds Darmstadtium, Rg Roentgenium, Cn Copernicium, Nh Nihonium, Fl Flerovium, Mc Moscovium, Lv Livermorium, Ts Tennessine, Og Oganesson.

I used as a reference the periodic table of elements with 118 elements without considering any expansions which, however, I carry over for the sake of completeness. Numbers from 119 onwards are still unoccupied and will be occupied when and if they are discovered.

All 118 elements can be obtained and the symbols of all elements can be easily traced. Let's take the example of the letter C...List all the possible ones: C, Co, Ca, Cs, Ce, Cu, Cr, Cf, Cm, Cd, Cn,Cl, specifically Carbon, Cobaltum, Calcium, Cesium, Cerium, Cromium, Curium, Cadmium, Copernicium, Chlorine. In this paper I will just inform you about the possibility to use creativity in teaching.

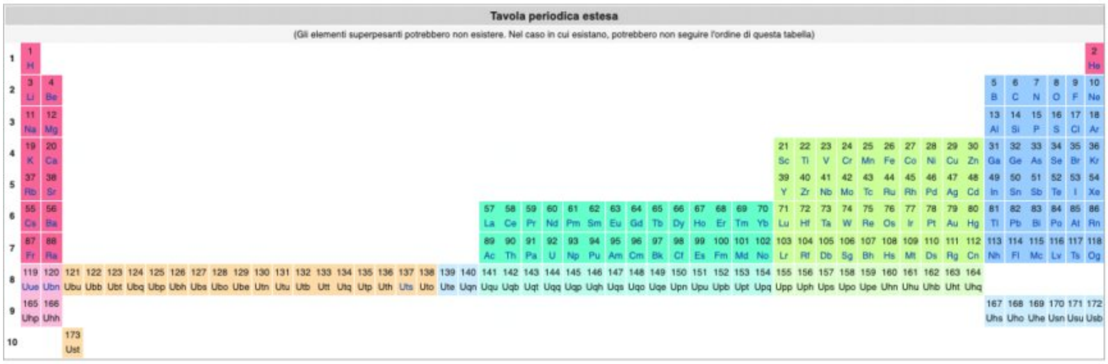
Periodic Table of Elements

I reported here an example of periodic table of elements with the last element Og (Oganesson)



Extension of Periodic Table

There are currently 8 periods in the periodic table of elements ending at atomic number 120. If further elements with higher atomic numbers are discovered, they will be placed on additional levels, positioned (like existing elements) in such a way as to illustrate the recurring pattern of the properties of the elements. Any further periods are expected to contain more elements than the seventh period, as they are calculated to have one more so-called g block, containing 18 elements partially filling the g orbitals in each period. A periodic table with an eighth period was proposed by Glenn Seaborg in 1969. [1][2] No element from this region has yet been discovered or synthesized. The first element has atomic number 121 with the provisional name unibiunium. These elements are expected to be very unstable to radioactive decay and have extremely short half-lives, although element 126 is thought to lie on an island of stability that is resistant to fission but not alpha decay. It is unclear how many items beyond the island of stability are physically possible, whether period 8 is complete, or if there is a period 9.According to the orbital approximation in the quantum-mechanical description of the atomic structure, the g block would correspond to the elements with a partial filling of the g orbitals. However, spin-orbit matching effects substantially reduce the validity of the orbital approximation for elements with large atomic numbers.



All of these hypothetical undiscovered elements are named after the IUPAC Systematic Naming of Elements, which creates a generic name for its use until the element has been discovered, confirmed, and an approved official name.

In April 2011, the synthesis was attempted only for ununennium, unbinilium, unbibium, unbiquadium and unbihexium (Z = 119, 120, 122, 124 and 126).

The placement of the g-block in the table (to the left of the f-block, to the right, or in between) is conjectural. The positions shown in the table above correspond to the assumption that Madelung's rule will continue to hold for higher atomic numbers; this assumption may or may not be true. In element 118, the 1s, 2s, 2p, 3s, 3p, 3d, 4s, 4p, 4d, 4f, 5s, 5p, 5d, 5f, 6s, 6p, 6d, 7s, and 7p orbitals are assumed to be filled, with the remaining orbitals empty. The eighth period orbitals are predicted to be filled in the order 8s, 5g, 6f, 7d, 8p. However, after approximately element 120, the proximity of the electron shells makes placement in a simple table problematic. There are other possible models for periodic tables with assumptions about the location of the elements, but for our purposes it is sufficient to report this example taken from (ref Wikipedia.)The importance of the periodic table is undoubting and let's see with some considerations: There are 90 natural elements in our planet and then exploiting them has huge environment, social, economic, and political implications. I remember here that UNESCO called the year 2019 "International year of periodic table 2 after 150 years from the first article by Dmitrij Ivanovi? Mendeleev. How is the periodic table being taught in school? All agree that this table shows some difficulties numbers, symbols, and propriety not easily learned. It is worth pointing out that these symbols are key-factors for learning chemistry nomenclature, compounds, and chemistry reactions. Nowadays, this is s sort of evolution in the periodic table and there is clear evidence of the importance of the elements. It is undoubtedly to recognize that each element is continuously monitored to prevent the total exhaustiveness of some of them. I remember helium here for refrigerator technology, Lithium in the cells, Ta tantalum coltan war etc. There is also a diverse method of teaching chemistry and different institutes run to discover the next probably for economic interest. For instance, the sixth element discovered by GSI and recognized by IUPAC was 112 elements, which is 227 times heavier than Hydrogen. At least cite rare elements, 17 elements to be precise.

Extended periodic table including G block

In addition, the scope of the periodic table and that of nuclides is restricted from the proton and neutron drip lines.

Failure of the Bohr model

There are as follows some consideration for elements with high atomic number in according Bohr theory and Dirac equation to provide insight what is possible could happen with new elements with Z>137. In both cases there are some difficulty to extend the atomic number so one wonders, if it is possible to obtain these elements and a quanto-mechanich approach help us to understand, but not solve this issue.

The Bohr model shows difficulties for atoms with atomic number greater than 137, because the velocity of an electron in a 1s electron orbital, v, is given

$$v = Z\alpha c \approx \frac{Zc}{137{,}036}$$

Where Z is the atomic number, and ? is the fine structure constant, a measure of [9]strength of electromagnetic interactions. any element with an atomic number greater than 137 would require the 1s electrons to be traveling faster than c, the speed of light. Consequently a non-relativistic model such as the Bohr model is By this approximation, inadequate for these calculations.

Dirac's equation

Even the semi-relativistic Dirac equation has problems for Z > 137, since the ground state energy is

$$E = m_0 c^2 \sqrt{1 - Z^2 \alpha^2}$$

It is not known how far the periodic table might extend beyond the 118 known elements. Glenn Seaborg suggested that the highest possible element could be below Z=130. However, if higher elements indeed exist, they are unlikely to be significantly assigned to the periodic table above approximately Z=173, as discussed in the following sections. This diagram therefore ends with that number, without implying that all of those 173 elements are actually possible, nor that heavier elements are not possible (Wikipedia).

The end of periodic table

Which is the last element? We don't know with certainty, but the elements are a finite number. Why is there a race to discover new elements? Probably there are different reasons; one could be the echo results in the scientific world to attract visibility. The second reason, in some cases, we know that at the end any experimental work could add hints to the material structure, and third, who knows the extra reason? Probably there is always a reason that I left it to people to guess. So the number of physically possible elements is unknown. There is a clearly a theoretical limit for neutral atoms at a Z of approximately 173,[6] after which it would be foolish to assign elements to blocks based on electron configuration. However, it is likely that the periodic table actually ends much earlier, probably just after the island of stability,[7] which is expected to be concentrated around Z = 126. [8] Further experiments are needed. However, a realistic calculation must take into account the finite extent of the distribution of nuclear charges. This results in a critical Z of

$\simeq$ 173 (unseptrium), so that neutral atoms are restricted to elements equal to or [6] less than this. The higher elements can only exist as ions.

Discussion and Results

There are few numbers in this short work. What is interesting is that with a simple sentence we can remember all the elements of the periodic table. I took from Wikipedia an example of a periodic table extended to complete the topic.

Conclusions

I hope that students appreciate this simple work, its originality and they find it useful at the same time as a trick as to promote and facilitate remembrance of all elements of the periodic table. Teaching is never sterile, and involving the audience is always a good way to promote the learning process.

References

Glenn Seaborg, An Early History of LBNL, su lbl.gov, 26 agosto 1996.

K. Frazier, Superheavy Elements, in Science News, vol. 113, n. 15, 1978, pp. 236-238, DOI:10.2307/3963006, JSTOR 3963006.

In April 2008, it was claimed that element 122 existed naturally, but this claim was widely believed to be incorrect. Heaviest element claim criticized, su rsc.org, 02-05-. URL accessed March 16, 2010.

Extended elements: new periodic table, su rsc.org, 2010.

Pekka Pyykkö, A suggested periodic table up to Z? 172, based on Dirac-Fock calculations on atoms and ions, in Physical Chemistry Chemical Physics, vol. 13, n. 1, 2011, pp. 161-168, DOI:10.1039/c0cp01575j, PMID 20967377. Bibcode 2011PCCP...13..161P, su adsabs.harvard.edu.

Walter Greiner e Stefan Schramm, Resource Letter QEDV-1: The QED vacuum, in American Journal of Physics, vol. 76, n. 6, 2008, p. 509, DOI:10.1119/1.2820395, Bibcode 2008AmJPh..76..509G., and the accompanying bibliography.

Glenn Seaborg, Transuranium element (chemical element), su britannica.com, Encyclopædia Britannica, ca. 2006. URL consultato il 16 marzo 2010.

Cwiok S., Heenen P.-H., Nazarewicz W., Shape coexistence and triaxiality in the superheavy nuclei, in Nature, vol. 433, n. 7027, 2005, p. 705, DOI:10.1038/ nature03336, PMID 15716943. Bibcode 2005Natur.433..705C, on adsabs.harvard.edu.

R. Eisberg, R. Resnick, Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, New York, Wiley, 1985, ISBN 0-471-87373-X.

James D. Bjorken, Sidney D. Drell, Relativistic Quantum Mechanics, New York, McGraw-Hill, 1964, ISBN 0-07-005493-2.

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Learning by Doing - Leveraging the Tinkering Movement for Global Innovation

Naman Agrawal* & Naba Suroor**

ABSTRACT

Effectively, every nation today wants to shift from its current economic activity to a knowledge and innovation-based economy. Often, the first step towards realising such intentions is that innovative workforces must be educated differently, and such education should start early. Science, Technology, Engineering and Mathematics (STEM) education has become essential for children across continents, highlighting the value and relevance of integrated understandings of science and technology in educational contexts and everyday life. The need for innovation and creativity is also recognised, which emphasises the critical role the arts can play as STEM is extended into STEAM (science, technology, engineering, arts and mathematics). As countries are still caught between the desire to bring about radical educational change and its actual implementation, many are leading by example, creating settings much more favourable to progressive educational ideas and practices and funding innovation-centric programs.

The paper explores the journey and learning of the tinkering movement in education and investigates the Atal Tinkering Labs (ATL) experiences in India. The ATL program rests on conceptual and technological pillars engendered in schools in India with a vision to 'cultivate children in India as Neoteric Innovators'. The article reconstructs the belief of the ATL initiative, analysing the parameters and trends that made it come to life and reach widespread acceptance while discussing educationally sound design principles for these labs. Eventually, strategies for adoption in large educational systems worldwide are suggested, such as the inclusion in national objectives and the implementation of tinkering labs by every school.

Key words: education; innovation; STEAM; STEM; Atal Tinkering Labs; neoteric

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Introduction

"The youth should have the courage to think differently, invent, travel the unexplored path, discover the impossible, conquer the problems, and succeed."

-- Dr. A.P.J. Abdul Kalam

Education systems worldwide struggle to support effective learning and overall learner development in an increasingly challenging world. The most difficult task is helping the learning ecosystem comprehend the shift to more future-oriented models. Embedding hands-on learning approaches and analytical skills into the learning models and building an understanding of real-life practice is a great place to start doing things better. Students working directly on real-life problems seem likewise ways to proceed.

In the truest sense, children are the most creative humans and natural creators and makers. We encourage children to play with sand, blocks, paint, and glue during their formative years. Children rapidly construct knowledge from what they already know and experience to create something new. The objective of teaching science and maths to children is not to make them pass tests but to enable them to make the world a better place. Yet, most kids are deprived of inventing building experiences until they endure a decade of structured learning. The natural thirst for curiosity often gets lost during these critical years of a child's brain development.

This paper addresses the challenges of the changing education systems. It provides valuable practical insight into the practices and policies in India that can support and enhance the impact of delivering learning in schools worldwide. Built on actual practices in real schools and collaborative working, the paper reflects the significant contributions of the Atal Tinkering Labs (ATL) initiative in Indian schools by the Government of India in generating understanding and how collaboration between students, teachers, and mentors helps. The paper outlines the implications for practice and policy and highlights the lessons and approaches that may provide the key to successful and sustained innovation. The ATL model offers excellent direction for educators seeking to build innovative and sustainable education models.

Background

The 21st century requires both employable job seekers and innovative and entrepreneurial job creators. Every innovator starts their journey as a 'tinkerer' who ideates, designs, and, most importantly, does a lot of experimentation and prototyping.

The concept of 'prototyping' has been completely transformed thanks to the semiconductors and computers around us. Two models of prototyping which we are going to focus on are - Evolutionary and Rapid.

The Evolutionary (or similar models like Spiral, Waterfall) model is a sequential prototyping process. Incremental steps are taken, and one needs good planning, experience, and foresight. Thus, this is one of the most trusted approaches in early engineering, where physical structures are created sequentially or part-wise. As computers became more ubiquitous, designers could decrease the mistakes and risks by creating simulations in a virtual environment. Object Oriented Programming (OOP) was deeply connected with the Spiral Design Model by Boehm in 1988. The whole paradigm of object-oriented paradigm is based on the concept of objects. These objects contain data, which can also be attributes or properties. In OOP, data structures or objects are defined, each with its properties or characteristics.

Rapid (or similar models like Iterative, Agile) prototyping is a reasonably modern, tinkering-friendly design model. Unlike Evolutionary, Rapid prototyping is more playful and does not have a set objective or deliverable at the start of the project. Maybe, that is why the Maker Movement has leveraged the 'Fail fast and move on' approach, and the mighty 3D printer is its torchbearer.

Of late, the relatively new phenomenon of 'Digital Prototyping', where software, apps, and websites are utilised for design, has enabled the design approach to go further. The exposure to learning material is beyond amazing, and the 2020 pandemic has just accelerated online learning and 'Digital Prototyping.' As the creator and user interaction is virtual, concepts such as 'User Experience,' 'User Interface,' and 'Digital Creativity' have become relatively popular in the tech industry.

Like a toddler who is the apple of the eye in a family, the world is highly obsessed with digital prototyping. Introducing coding to students is excellent, but it cannot be objective. Parents must understand that coding is just a tool or toy that children can play with while developing their skills and that a child's development is like a tree, not a staircase.

Skipping steps cannot be the approach to achieving excellence. Foundational education and cognitive skill development are essential. As educators, teachers, parents, and well-wishers of our children introducing the above methodologies and relevant tools at the 'right time' during a child's learning cycle are critical. Please note the usage of 'time' instead of 'age' because every child is at a different learning stage, which profoundly influences the people, atmosphere, and access to knowledge.

Makerspaces and Learning

Makerspaces are collaborative workspaces where young people gain practical hands-on experience with new technologies and innovative processes to design and build projects. Makerspaces represent a radically different mindset that arose from the culture and community of the Maker Faires and the Make Magazine . Makerspaces are physical spaces for making that range enormously in format. They represent a flexible set of technologies and concepts by Dale Dougherty and his Make Corporation and MakerEd nonprofit organisation .

There is an unprecedented social acceptance of the changes that the maker movement can bring to education and a robust research infrastructure to measure its outcomes. The costs of software and hardware tools are quickly dropping, and several new, student-friendly tools are being created in research and design labs, be it the emergence of Hackerspaces in the 1980s in the USA and Europe or the introduction of FabLabs after the hackerspaces.

An educational space or workspace can enhance student learning by developing skills contributing to personal growth and engagement. Makerspaces provide a safe space for students to experiment, innovate, and acquire new skill sets through hands-on instruction. Students develop design thinking, 21st-century skills, and service-learning experiences through hands-on education and making. These laboratories have room to contribute new approaches to teaching in which teachers are not the only drivers of knowledge that students receive passively.

Instead, students are encouraged to actively participate in learning through investigation, creative thinking, problem-solving, and collaboration. In addition, skills acquired through hands-on learning enhance student engagement and support students' post-secondary transition.

* Educational maker spaces are especially beneficial for special education students. You can help students with unique learning needs learn independently and develop practical and business skills, creative thinking, problem-solving, and collaboration. It also provides an environment that allows students to express themselves without fear of disappointment, helping them feel empowered and in control of their learning. Much of the literature on transition programming addresses the impact of makerspaces that promote positive outcomes for students with special needs. However, one empirical study suggests makerspaces can help emerging adults gain entrepreneurial skills and develop a sense of community belonging.
* The inclusion of makerspaces can help institutions provide qualified candidates to fill local skills gaps. They offer unique opportunities to incorporate maker space practices into your curriculum and collaborate with local job training programs to build a pipeline of qualified makers at all grade levels.
* Schools must train teachers to link makerspace practices with classroom instruction. Educators must understand how makerspaces work to play an active role in designing and implementing maker activities into daily instruction. Educators must consider the school context and the needs of students to implement maker learning practices and continually build students' confidence to engage in makerspace learning.

Overview of Atal Tinkering Labs

The Government of India established the Atal Innovation Mission (AIM) in the NITI Aayog. Realising the need to create a scientific temper and develop the spirit of curiosity and innovation among young minds, AIM has established a 10,000 Atal Tinkering Laboratories (ATL) network in schools across India . The objective is to create workspaces where young minds can learn innovation skills, sculpt ideas through hands-on activities, and work and learn in a flexible environment. The ATLs are to enable young India to build groundbreaking solutions for the country's unique problems and thereby support India's efforts to grow as a knowledge economy.

Based on the Indian experience, ATL labs are seen to act as incubators of ideas, allowing the country's young students to step out of their comfort zone and work on new concepts, embrace futurism, and build confidence & personality skills.

ATL schools in India are doing exceptionally well. They actively engage with nearby schools, creating a vibrant ecosystem of innovative thinking within the school and community.

A growing trend in education in India, ATLs provide hands-on learning opportunities for students to design or build projects using various physical and digital tools. Although "ATL" is relatively new and reflects a recent educational trend, it aligns with well-established instructional principles. These principles include experiential learning, which emphasises "learning by doing" and allows students to solve problems and take ownership of their education.

As such, ATLs provide new educational opportunities, especially for students who thrive in non-traditional learning environments. ATLs equip students with skills through hands-on instruction. Improve student learning by building skills that contribute to personal growth and engagement. Given the difficulty of identifying the impact of ATL on student learning on standardised test scores, the survey analysis highlights the skill sets acquired by students to argue for the positive effects of ATL on student success. For instance, one of the teachers surveyed emphasised "it is the combination of design thought processes, service learning experiences, and 21st-century skills that are developed at ATL that have a positive impact on student learning." The following section summarises these ATL frameworks and provides examples of how ATLs develop skill sets in young learners.

a. The Atal Tinkering Lab Framework

The ATL program design and implementation follow a plug-and-play approach. It includes standard guidelines, curriculum, training tools, and standard operating procedures (SOP) and is supported by a robust information technology (I.T.) system and several partnerships. It creates a culture of innovation and a vibrant, collaborative ecosystem within the Indian school community by celebrating and recognising innovative students, teachers, mentors, parents and other stakeholders.

The four-pillar implementation framework (Select-Establish-Enable-Celebrate) is illustrated below:

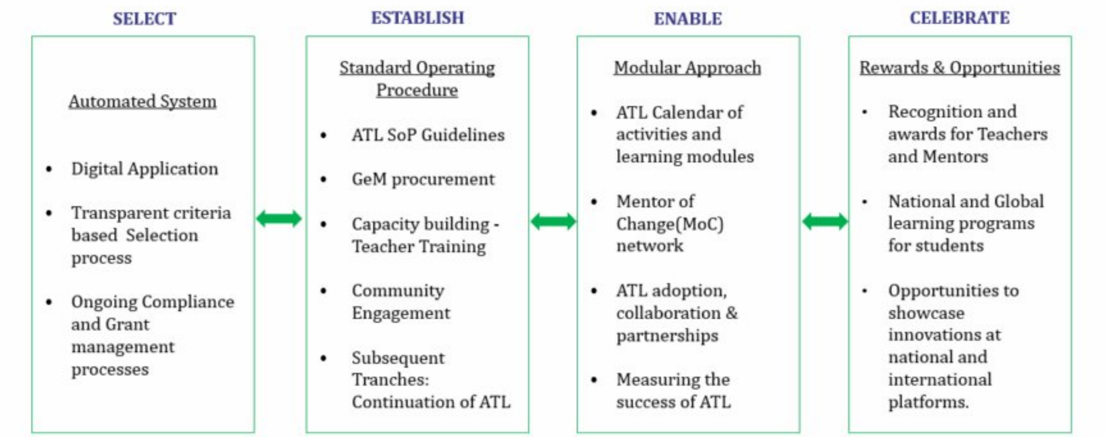

Figure 1: Framework of ATL Program

b. Indicators of Student Learning in ATLs

Design Thinking

A problem-solving framework that helps students define problems, empathise with those facing those problems, develop prototypes of possible solutions, and refine those prototypes through multiple iterations until generating a viable solution to the challenge. In ATL, students carefully plan their designs and record their thinking before diving into the construction phase. After completing an initial design prototype, students reflect on their creations and plan to iterate to improve, and the design cycle begins again.

An instructional approach is adopted in which students apply academic knowledge and skills to meet the community's needs. Students identify a need in their community, develop a plan and solution to address it, and then use ATL to implement their solution.

21st Century Skills

The World Economic Forum's Future Jobs Report lists the top 10 skills needed to thrive in the workforce by 2025: analytical thinking, active learning, creativity, leadership, resilience, and the ability to use technology. ATLs help students develop most of these ten skills: problem-solving, critical thinking, creativity, innovation, active learning, and technology use. Similarly, ATLs engage students to learn by providing opportunities to have unique experiences and develop the following skills:

* Develop 21st-century employment skills by way of solving problems and thinking creatively.
* Deepen what is learned in STEAM (science, technology, engineering, arts, and mathematics) classes by connecting with real-life tasks and problems.
* Explore their interests and develop creative solutions to real-world problems.
* They are learning by playing at their own pace by developing self-confidence through designing and creating objects.
* Develop intergenerational relationships and build communities.
* Develop collaboration skills and educate others on what they learn.
* Develop fine motor skills by using physical tools.
* Learn by trial and error, take risks, and persevere.

Schools are adopting ATL programs for science, technology, engineering, arts, and mathematics (STEAM) education using innovative technology tools to keep students engaged and motivated.

c. Impact of ATLs on School Students

In many cases, teaching subjects inside the classroom only with the help of textbooks is monotonous. Because of their very structure, these subjects may appear complicated.

* The theories, principles, properties, theorems and doctrines presented in STEM subjects may seem convoluted for many students. So, the general student takes the easy way out and memorises these things without understanding the examination.
* No wonder many high-grade students cannot remember even the essential STEM texts and references they read in lower grades.
* Therefore, the foundation of STEM is relatively weak in many students; over a while, they get detached from the matter(s) due to limited engagement.
* One of the significant challenges posed by traditional classroom learning (through textbooks) is that even students who join the relevant fields of engineering, science or mathematics remain limited to the dry & standard professional requirements of their job instead of following an innovative approach to their work.
* The lack of innovative practices in STEM subjects limits students from taking full benefit of their potential.

While working with relevant tools and helpful ambience provided by an ATL, students can:

* Learn the complex aspects of STEM subjects more directly and engagingly.
* They are engaging multiple brains to practically experience the concepts of STEM subjects which help them to retain the different aspects of the topics.
* Develop a natural tendency towards "innovating" rather than sticking to the limitations of learned words via the Do-It-yourself ambience of the ATL.
* Ideally, blend the left (logical) and correct (creative) brains and develop a natural "liking" towards their subjects.

Depending upon their inclinations, the ATL movement teaches two sets of critical desires within students: to learn something new (learn ATL technology and resources) and to become innovators/ entrepreneurs (solve challenges by leveraging ATL technology and resources). The ATL movement today has matured into an 'Operating System', upon which the ATL initiatives are being run to cater to the critical aspirations of its beneficiaries.

Atal Tinkering Laboratories (Learn, Think, Make, Break, Create and Collaborate)					
Aspiration	Skill (To learn something new)			Entrepreneurship (To become innovators/entrepreneurs)	
Resources	Coding	AR/VR	CAD	Industry Internship	Startup via AIC/ACIC
	3D Printing	Robotics	Artificial Intelligence	Student Innovator Program	
	Game Design	Intellectual Property Rights	...and many more	Student Entrepreneurship Program	
Outcome	Learn 21st century STEM skills with ATLs			Create indigenous products and solve challenges	

Figure 2: ATL Operating System

The ATL is undoubtedly a disruptive innovation that can equip students with tools needed to succeed in higher education and the workplace, like self-confidence, preparedness, innovation, creativity, imagination, tinkering & research skills, and pitching and presentation skills. India has created, without a doubt, a stable, multi-stakeholder, scalable and foundational framework through these ATLs for building a new and resurgent nation.

Given the initiative's success, the need of the hour is to scale up this ATL model of India to include every school globally. Global policymakers need to redouble efforts to expand and accelerate this inclusive model for innovation by providing an equal opportunity to all regions and all children, irrespective of the rural-urban divide and government-private divide, through public-private partnership and centre-state partnership. Considering both the short and long-term benefits, all schools and their managements, as well as principals and teachers, need to be highly proactive and design a similar program for the students in their region or country.

d. Learnings from the ATLs

The ATL initiative taps into children's intrinsic imaginative and problem-solving knack and equips them with the required skills for the future. They can be effective in developing cognitive and technological skills in school students. Access to multiple ATL resources helps them to ideate and create feasible solutions to substantial community problems. And the support of students, teachers, principals, mentors and parents is considered crucial in successfully achieving the objectives of ATL. A recent independent survey conducted at the end of 2022 indicated early signs of how ATLs positively impact children's mindsets.

e. Understanding Student's Survey Report

The students surveyed cover all classes from 6th to 12th, with a slightly lower percentage from classes 6 and 7 and a slightly higher percentage from classes 9 and 10 (secondary school). Most of these students attend ATL weekly.

While students report diverse subject preferences, a large majority (79.8%) plan to choose/ have chosen science as their stream in classes 11 and 12 (senior secondary school). Maximum students report their favourite subjects as Maths and Physics. Also ranked among the top favourites are English, Biology, Geography, Physical Education (P.E.), Commerce/ Economics, and Arts - all diverse subjects which are not intuitively linked with the ATL.

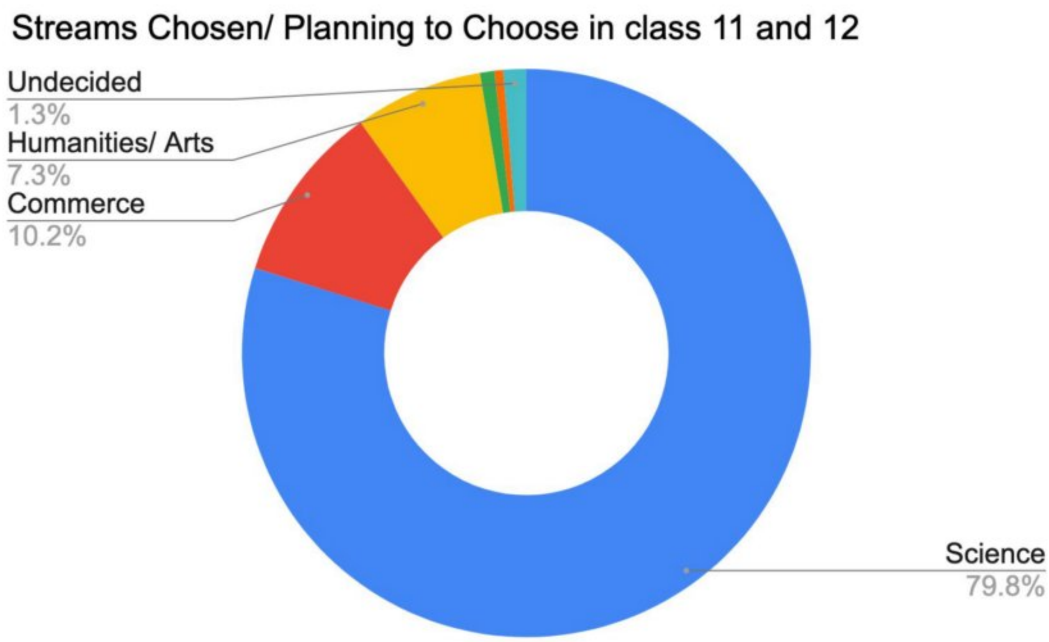

Figure 3: Streams Chosen/ Planning to Choose in Class 11 and 12

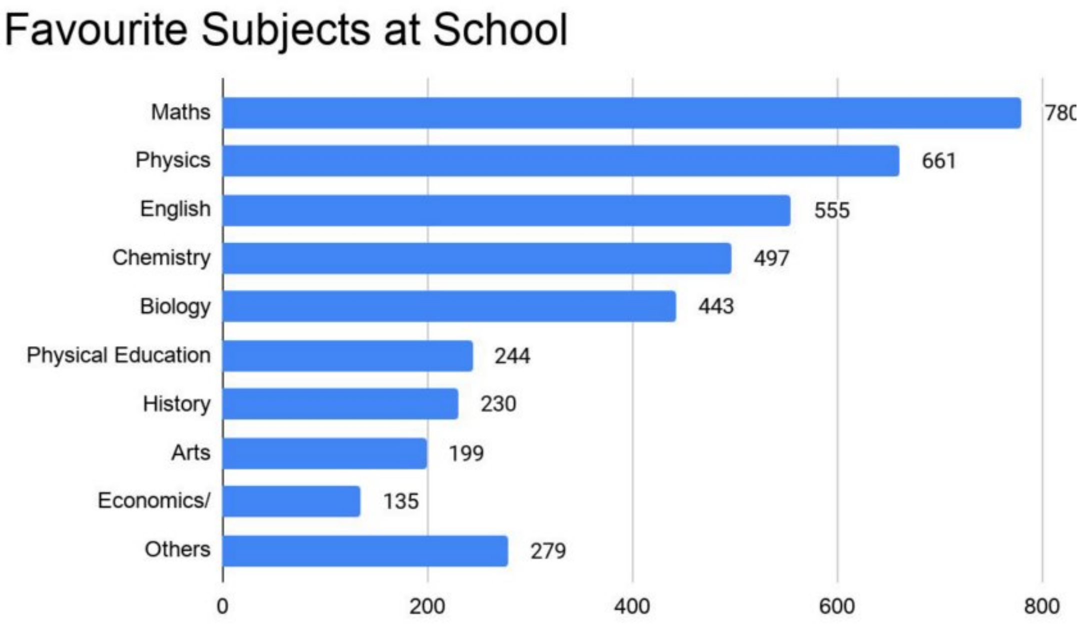

Figure 4: Subjects at School

Student's Attitudes towards Subjects: Students report that Physics (48.9%) and Technology (75.1%) are regular ATL topics. Other common subjects are Maths, Chemistry, and Society and Community. Most students agree (78%) that the ATL is not just for students interested in science. Most also agree (77.7%) that ATL projects do not always have to use science and technology as long as they are creative.

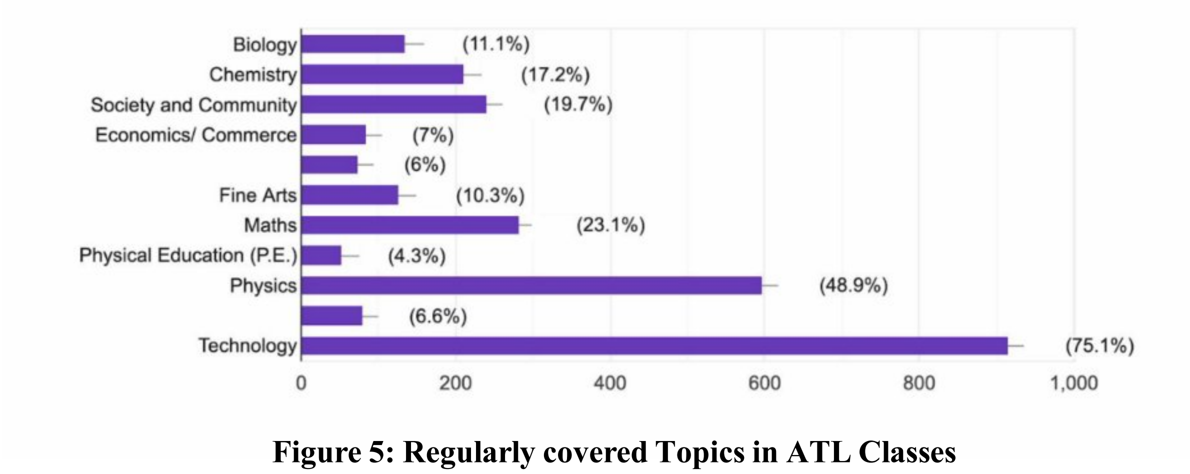

Figure 5: Regularly covered Topics in ATL Classes

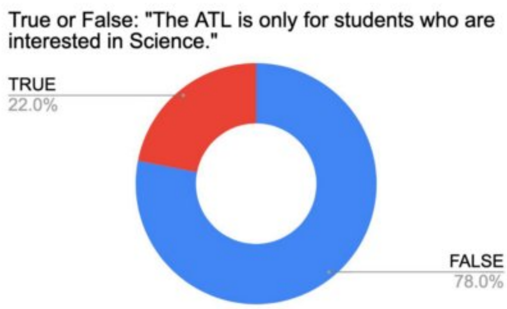

Figure 6: Student beliefs about the aptitude of peers in ATL

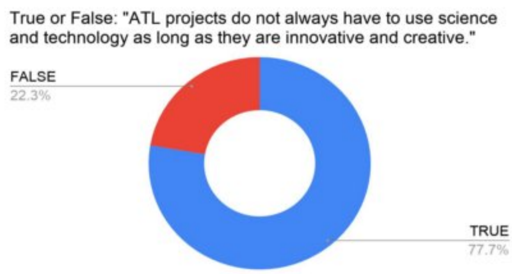

Figure 7: Student beliefs about innovation in ATL projects

f. Atal Tinkering Labs Outcomes and Impact

Adopting an outcome-based approach is essential to impact the ground substantially. And it is necessary that the overall outcomes are continuously monitored and corrective measures taken in real-time. The success of an ATL is measured based on both quantitative and qualitative parameters, which include inputs, outputs, outcomes and overall impact created, as illustrated below:

INPUT	OUTPUT	OUTCOME	IMPACT
10,000 ATLs Established 20+ ATL Curriculum Modules Monthly ATL Calendar of Activities	75,00,000+ Students Engaged 12,00,000+ Innovation Projects Created 5800+ Mentors of Change	60%+ ATLs in Govt./ Govt. Aided schools and 96% in Girls/Co-Ed Schools Holistic development of Students with enhanced exposure to industry	Development of Creative Mindset Development of 21st Century and Technical Skills

Figure 8: The ATL Approach

g. Skills developed through ATL Activities

* Practical and Vocational Skills: STEAM education through ATL can provide skills that lead to jobs after post-secondary education programs. ATLs promote life-long continued learning and acquiring new knowledge, skills and technologies. Students learn to apply their learnings effectively while also understanding the principles of sustainable design and development.
* Problem-solving: ATLs allow special education needs students to master complex academic concepts, improving their confidence, teaching them how to regroup after failure, and improving communication skills. An ATL teacher surveyed noted that "ATL students are quicker and more assertive in identifying a problem and determined to find a

solution, in comparison to the non-ATL students."

* Student engagement: Teachers reported that the ATL activities' hands-on nature facilitated student engagement, as they relied less on students' reading or math skills than traditional instruction.
* Student collaboration: Teachers noted student collaboration across different activities. A teacher mentioned that students were encouraged to work in groups for the ATL activities and projects. They understand the importance of teamwork and function effectively as a team member. Students accept and provide feedback in a constructive and considerate manner, thus helping them realise that they can help each other with troubleshooting processes.
* Mental and emotional health: School administrators note the role of the ATL as an educational resource and a calming environment that helps students focus while providing a dynamic outlet.
* Creativity: ATL encourages open-ended exploration. Allowing students to follow their creative process can empower them to take command of their learning. Teachers have noted that solutions and the projects created by ATL students reflected original thinking. Furthermore, students rapidly ideated multiple new designs in a single lesson.
* Critical Thinking: In one of the lessons, critical thinking was evident when students were required to think carefully about decisions like how to best customise the design of their keyring to meet the needs and interests of the teacher they interviewed.
* Inquiry: Teachers highlighted the increased capacity of students to conduct open-ended discussions. A teacher noted that ATLs provide students with experiential opportunities, facilitating growth through experience. Inquisitive learning as a learning strategy can support a meaningful learning experience, further enhancing students' education.
* Autonomy: Teachers noted high levels of student autonomy and self-directed learning. Students also referenced how much they enjoyed controlling what they were doing and creating.
* Literacy: Teachers highlighted how ATL activities improved students' language skills by acquiring new vocabulary. They also noted substantial gains for students who had historically been weak at reading and writing because they could engage in the language tasks in a highly applied way. ATLs enable students to utilise language skills to work collaboratively on activities, workshops, seminars and other ATL-related events.
* Numeracy: Teachers identified how numeracy and mathematical skills were intrinsically developed during the design activities. For instance, when dealing with 2D and 3D shapes in computer-aided designing, students created an applied understanding of size and proportion.
* Scientific and Technical Understanding: Teachers observed in some classrooms how addressing scientific problems could promote deep and rich scientific understanding. There were improvements in students' technical capabilities when they demonstrated the capacity to create, position, resize, rotate, and join the 3D objects as part of

computer-aided design activity within the lab.

* Real-World Connections: Teachers observed how ATL activities helped students address authentic problems. Students were encouraged and chose to design projects to tackle real-world issues and problems like the need for low-cost water purification, etc.
* Reflective Thinking: A teacher noted that the students were very thoughtful about their learning designs and could identify what worked, what did not, and possible ways to make it work.
* Resilience: Teachers noted increasing students' perseverance and resilience. For instance, students were not intimidated when finding design issues or dealing with technical problems with equipment like a 3D printer.

h. Best Practices from Atal Tinkering Labs

The diversity in the region, students, ethnicity, culture, affiliation, management and faculties in the ATL schools in India have revealed different types of best practices, which may be adopted by the prospective ATLs, regionally or nationally. Schools have found simple and effective ways to overcome adversity based on the resources available to them.

Some of the most innovative practices schools have successfully implemented in their ATLs have been identified. These best practices inspire the entire ATL ecosystem to thrive and achieve the best results, regardless of any limiting factor. The best practices can be organised as per the framework - "Establish--Enable--Celebrate", as illustrated below:

Figure 9: The ATL Framework

1. Establish

1.1. Peer-to-Peer Learning and Mentoring: In the Indian context, bright ATL students were identified and encouraged to volunteer as 'student mentors' to take ATL sessions for school children and teachers. ATL student mentors were also involved while planning ATL sessions and curriculum. It has been observed that peer-to-peer learning also enables the ATL In-charge to save time and focus on additional ATL work.

1.2. Mixed-Age Classroom Learning: Interestingly, many ATL schools in India conduct ATL classes during an expected period so students of different types and age groups can work together in teams. In mixed-age classrooms, students learn teamwork, one of the most important 21st-century skills. They improve their leadership and communication skills and learn to support one another.

1.3. Developing an ATL Curriculum: Through interactions with numerous ATLs across India, it has been perceived that ATLs design their curriculum per the school students' capabilities and available equipment. They also define month-wise and session-wise topics to be covered in classes, including practical and theoretical sessions. A well-defined curriculum structures ATL classes and ensures their sustainability.

1.4. Designing an ATL Textbook: An ATL school in India has introduced a textbook for its ATL, which the school has created. The comprehensive book covers all the essential technological concepts tailored to the ATL needs, equipment, and student's level of understanding. The school proudly shares that "the textbook consolidates the students' knowledge, provides structure to classes, and ensures the sustainability and replicability of the ATL classes."

2. Enable

2.1. Surprise ATL visits by the Principal: The principal (head of the school) of one of the surveyed ATL schools has formulated the concept of "surprise visits" in their ATL. The school elaborates that active involvement of the principal in the ATL, by attending an ATL session once a month and taking updates from the ATL In-charge, proves helpful. If the principal shows interest in the ATL activities, the students feel motivated, and the In-charge is kept accountable.

2.2. Engaging students from Non-Science Streams: Many schools in the country are organising regular ATL activities such as workshops on technology and innovation across streams - Commerce, Humanities, Science, and Vocational, to teach a problem-solving mindset in all students. One such school highlights - teachers have observed that diverse students across streams feel motivated to engage with the ATL. This encourages innovative problem-solving from multiple perspectives, as students from different disciplines may tackle problems uniquely.

2.3. Introducing Parents to the ATL: The ATL initiative strongly promotes the inclusion of parents in the ATL through exhibitions and live demonstrations during the school's cultural events. By experiencing ATL projects first-hand, parents are more inclined towards their child's participation in the ATL.

2.4. Understanding Community issues through Parent Engagement: Engaging with parents substantiates students' gain insights into the everyday challenges of their community. Engaging with the parents helps students gain deep insights into community challenges and sustainable design solutions. The ATL In-charge also engages with the community through organic networks.

2.5. Engaging with Community Mentors: The mentor network firmly supports the ATL initiative . It further inspires me to connect with innovators in the community who are knowledgeable in technology as 'Community Mentors.' With community mentors, ATLs receive guidance and support from their community.

2.6. Field trips to understand Community Challenges: An ATL school located in the rural parts of the country articulates that taking the ATL class on a field trip to local spaces is a learning experience for the students. They can observe common challenges and brainstorm solutions relevant to their community. Through community-based field trips, students learn to connect innovation with real-world problems. This helps the school build an innovation ecosystem rooted in relevant community challenges.

3. Celebrate

3.1. Conducting Intra-School Competitions: Various active ATLs in India have adopted the practice of organising intra-school competitions to motivate students. This encourages the students with a budding interest in innovation who have not yet represented the school in external competitions. Such competitions boost the student's confidence, while such friendly tournaments are a stepping stone to inter-school competitions.

3.2. Showcasing Student Projects: The ATL program introduces theme-centric activities and theme-based challenges for students to create monthly projects. Furthermore, exhibitions and project showcases are regularly supported. ATLs are also maintaining a mode of communication, such as a social media group with parents and students to share achievements.

V. Approach for establishing Tinkering Labs in a Country

The ATL initiative, across India today, is tapping into children's intrinsic imaginative and problem-solving knack and equipping them with the required skills for the future. The primary focus of introducing a tinkering lab in any country is to increase engagement within the school. It will also help understand how best it can engage with students from nearby schools and the community, over and above their school students.

It is proposed to introduce global tinkering and innovation to schools, thereby integrating them within the world's larger innovation ecosystem. This tinkering lab equivalent of an ATL will enable young minds to enter a Do-It-Yourself (DIY) mode and learn innovation skills. Young children can use tools and equipment to understand STEM concepts (Science, Technology, Engineering and Math). They would benefit from learning the best practices already identified in the ATL program the Government of India implemented. Students, teachers, volunteer mentors, and an entire innovation ecosystem for school-going children could be harnessed and replicated as done in India. This promises a new start in spreading the tinkering innovation movement across the global youth.

An initiative like this shall tap into the interest of each nation's community to implement the innovation model within their country, revolutionising STEM education in their school ecosystem.

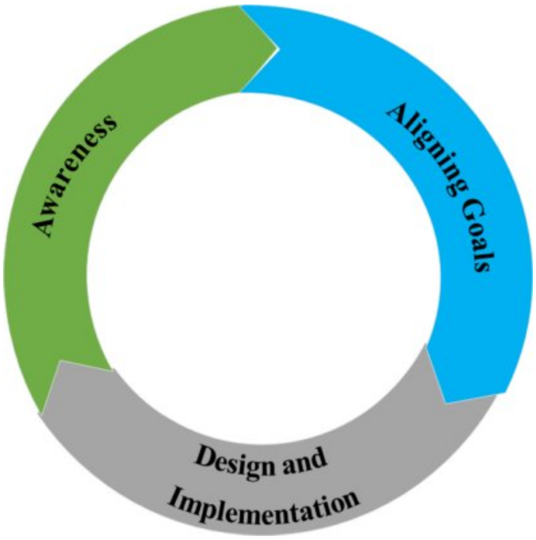

Figure 10: The Implementation Approach

a. Aligning Goals with Mission

* Aligning the goals of the tinkering lab with the school's academic objectives helps teachers better understand how implementing activities could benefit their students and incentivise them to do so.
* Teachers must identify skills that align with the school's mission and draft learning objectives for each skill.

b. Designing and implementing the year-round activities

Teachers can implement tinker-based activities through the tinker sprint model, which includes the following three steps:

* Exploration, where teachers build excitement around a topic and activate students' prior knowledge.
* Skill-building is where teachers instruct students on developing proficiency with a particular tool or material and how to connect it to learning content objectives.
* Challenge, where teachers pose an open-ended problem in which students can use their new knowledge.

c. Awareness of the Importance of Tinkering Labs

Teachers should participate in professional development programs to better understand how they can connect classroom instruction with tinkering activities. Educators must consider the context of their students when aligning tinkering labs with school curricula.

The implementation considerations below can help teachers build and sustain these tinkering labs or workspaces that empower students to take ownership of their learning.

VI. Implementation Roadmap

Implementation/ Expansion of the 'Educational Tinkering lab' model to all the schools may be taken up independently by every country's respective government, per their administrative approvals and budgetary provisions.

Figure 11: The Implementation Roadmap

1. Beneficiaries and Selection Process

* The educational tinkering lab can be established in any (govt-funded or private) primary and lower secondary school with access to lower secondary grade students.
* The school selection to establish the tinkering labs should be based on geographical distribution, population density and other local accessibility factors.
* One reproducible selection criterion used to select ATLs in India can be replicated.

2. Funding Support

* A formal process for setting up the infrastructure of the educational tinker space within a school and explicitly procuring equipment for the established school should be devised.
* An exhaustive standard equipment list should also be designed. The tinkering lab must contain all equipment from the definitive equipment list. Additional equipment may be added by the country's government if required.
* However, little flexibility must be provided to allow the school to procure equipment the government does not cover. List but would enhance the tinkering experience. Given the rapid pace of technology development, there is bound to be the latest tech equipment which can be introduced to students. A successful use case could then be submitted to the govt-equipment list.
* The government shall provide the establishment cost directly to the respective school. Equipment procurement shall be done by a government-approved agency/ company/ organisation only.
* The guidelines regarding using grants for schools in India can be accessed for reference .

3. Deployment and Implementation Plan

* Government support is crucial in the co-creation, strategic guidance and ecosystem development for the effective implementation of any educational tinkering lab.
* The country's government should identify a Nodal Center/ Institute to support establishing tinkering labs within their country.
* Knowledge Repository: To pass on the knowledge and ignite the spirit of tinkering within students, there must be a repository of content and resources for the students and teachers alike to learn from to ensure a successful implementation of the initiative. The content can include videos, documents, and other handholding material for conducting the activities and sessions.

For successful ATL implementation, India has a vast repository of content and resources that students and educators can access. This information is also quickly and publicly accessible .

* Capacity Building and Teachers' Training: In the initial stages of the tinkering lab setup, the schools and teachers require training and handholding facilitated by a sustained engagement with subject experts. For this, the tinkering lab should utilise the country's corporate network to organise capacity-building workshops for teachers and students in their region. The model used

by India's teacher training program can also be helpful to other countries.

* The Mentors Network: Establishing a group of 'volunteer' motivated and competent individuals who can ensure the smooth execution of all the activities in their respective schools/ regions will be beneficial. Like in India, the 'Mentor of Change' Community can be leveraged and worked with to develop a student-centric innovation ecosystem .

4. Monitoring and Compliance

All the selected tinker-space schools must follow a set of guidelines and compliance processes for successful implementation in their school:

* Equipment Procurement: The educational tinker space must procure the equipment only through a government-approved agency/ company/ organisation/ vendor. Vendor registration on Government E-marketplace (GeM) portal is mandatory in India .
* Financial Expenditure: An educational tinker space must use a government-monitored finance management system in the country to record all financial transactions (including online, offline, equipment procurement transactions, etc.) related to the tinkering lab. India uses the Public Finance Management System (PFMS) portal for this .
* Monitoring & Governance Dashboard: The country's Nodal Center/ Institute must establish an online mechanism for monitoring and evaluation. The tinkering lab schools can periodically update with the conducted activities and operations details.

The online dashboard monitoring the ATL schools in India is a promising paradigm for this .

* Performance Enablement Matrix: The tinkering lab should adopt the Performance and Enablement Matrix Framework (PE Matrix) to enable self-evaluation of labs. Using the framework, they will easily be able to identify their strengths and weaknesses under the twin pillars of Performance and Enablement. In order to enable the tinkering lab to initiate suitable course correction measures, post evaluation, the framework also provides an easy-to-understand pathway, specific to each of the outcome bands.

The PE Matrix Framework adopted by the ATL schools in India is an apt model for this .

* Fund Utilisation: The grant/ fund being released to the tinkering lab should be exclusively spent on the specified purpose for which it has been sanctioned within the stipulated time, as per the approved guidelines.

5. Enablement Plan

Some initiatives and efforts to enable the effective and proficient implementation of the tinkering lab will also be needed.

* Collaborations & Partnerships Support: Forging robust partnerships with the industry and academia to leverage their expertise is critical. Sustainable institutional frameworks that draw upon these partners' capacity, resources, and technical know-how will be essential to ensure the program's success. Partners help expand the students' technological horizons by providing internship

opportunities and guidance with their innovations, strengthening the tinkering lab knowledge repository and so on.

* Student Exchange Programs: Launching Tinker-Space Innovation Boot camps or Student Exchange Programs, where students from different countries collaborate to innovate and identify solutions for global challenges. This bilateral initiative will be an opportunity to create an innovation exchange bridge for the youth to equip them with globally relevant skills.
* Challenges and Hackathons for Students: Once the tinkering lab is fully functional, it must organise and conduct regular tinkering activities to keep the students engaged and inspired. The educational tinker-space can conceptualise and implement such initiatives to successfully implement the program.
* Tinkering lab Alumni Engagement: Identity/ track the Tinkering lab Alumni to build a strong and sustainable innovator network.

VII. Implementation Considerations

a. Adaptable Design

The tinker-space structure must adapt to each school's unique and distinct mixture of needs, goals, and vision for effective implementation. Each school can interpret what a tinkering lab means in the context of localised needs and dynamics and how they wish to implement it.

b. Consider Student Comfort Levels

Educators should consider that some students, especially those accustomed to concrete instructions, might feel disoriented with maker activities. Educators should find ways to ease students into becoming confident tinkerers.

c. Consider Alternative Assessment Tools

Open-ended projects do not lend themselves to standardised evaluations. Therefore, educators should create alternate assessments that give teachers more explicit pictures of student learning.

d. The Power of Partnership

Having an external partner can help shape innovation in the school and catalyse a range of benefits. A third-party/ external partner provides the necessary resources and expertise and focuses on helping the school move forward more quickly toward their goals. The external partner can bring in the support and resources that might not otherwise have been available.

e. Cluster-based Approach

To enable better monitoring on-ground and embrace a sustainable way of assessing tinkering labs, a cluster-based approach should be adopted, wherein the Central and relevant local authorities within a country like the State/ City Government, innovation councils, organisations, etc. come together to leverage human capital and ownership in order to ensure smooth functioning of the tinkering labs. It is a self-sustainable model for monitoring and evaluation wherein the tinkering labs and the local authorities work in tandem with each other on-ground to form clusters of 20-30 labs in a particular region. This provides a sustainable model which clearly defines and assigns ownership by way of following a decentralized approach and leverages the concept of competitive federalism to increase the efficiency of the tinkering-space, thereby enhancing their performance.

f. The Mentor Network

The success of an innovative and engaging tinkering lab depends on the individuals directly contributing and engaging with the community. And therefore, micro-communities of innovation must be created and managed by the local people within those regions. A mentor network is a group of motivated and competent individuals with the drive and a sense of direction to sow the seeds of innovation in their area of specialisation. These mentors ensure the smooth execution of all tinkering lab activities in their respective schools/ regions.

VIII. Recommendations for Tinkering lab establishment in other countries

1. Agile Approach

An agile approach to an initiative encourages testing ideas, promptly learning the needs or context, and adjusting as needed. Agile practices in education encompass addressing the learner's requirements early on, changing to meet those needs and implementing the solutions for evidence-based effective models.

2. Conducive Policies

The tinkering lab structure reflects critical insights into how it promotes innovation and change. It also creates a structured space to try new approaches through risk-mitigated facilities that result in effective change in schools and their students. Innovative learning designs can emerge from these experiences to inform and test policy development for different regions.

3. Resource Allocation

Requisite financial support with additional human capital is essential for building sustainable learning environments. Pertinent decision-making is needed for fund allocation, competitive staff and increased flexibility to enable practical innovation.

4. Teacher Capacity Building

There is a pressing need to create an ecosystem that infuses educator competencies and capacity-building to improve innovation, design skills, and current pedagogical practices-introducing policies prioritising and protecting the ability of teachers to cultivate new competencies and facilitating alternative methods and supportive environments for the same.

5. Learning from Failure

The tinkering labs are about creating a culture in schools which is more open to risk-taking so that students and teachers are encouraged and empowered to experiment with innovative ideas and models. The students, teachers and other key stakeholders need a safe space to share perspectives about practice and learning from their failures.

6. Quality Assurance

There is a need to review the effectiveness of the program continues to:

* Understand the quality and functional performance metrics of operational tinkering labs.
* Compare various subjective and objective parameters of the school, students and ecosystem before and post-establishment of the tinker space/ workspace.
* Improve understanding of the impact of the educational tinker space by studying short-term and long-term metrics.
* Track and understand the education and

career journey of the tinker-space students.

* Track the change in the mindset of the teachers working in the tinker spaces supporting schools.
* Understand the impact on the community posts the introduction of the tinker-space/ workspace in the school.

IX. Program Assumptions

1. Availability of Competent Teachers in the proposed Tinkering Labs

The tinkering lab staff gets dissolved when the head of the school (Principal) or the teacher In-charge is transferred to other schools. This should be avoided since knowledge transfer and continuity in tinkering lab activities becomes difficult. Allocating some funds as an honorarium would incentivise more dedication since the teacher In-charge takes up dual responsibilities of the tinkering lab and the regular school.

2. Active Mentor and Expert Community

Active participation of the Mentors and Expert Trainers needs to be ensured by allocating accessible and relevant experts as the formal Mentors. Establish a channel between schools and mentors wherein they engage with the mentors effectively. Regular Regional Mentor meets will enable ironing out the mentor program. Developing a comprehensive incentivisation strategy for mentors through a monitoring mechanism and regional leaderboards is recommended.

3. Density of Schools and Availability of Ecosystem Enablers

The ecosystem approach always helps amplify the impact being driven by such tinkering labs. Hence, geographies with a higher density of academic institutions and other enabler institutions such as higher education institutions, corporate organisations, and other philanthropic firms may be chosen to establish these tinkering labs.

4. Regional Monitoring Committees

There should be Regional Monitoring Committees to periodically review and interact with the tinkering labs in their respective Region. A mechanism may be devised such that the Regional Monitoring Committees (RMCs) conduct a review of the labs in their respective region and undertake field visits at regular intervals.

5. Enable Peer-to-Peer Learning

Creating a regional network of tinkering labs within a country/ region to enable peer-to-peer learning. Periodically conducting teacher training sessions will also create a positive sense in the tinkering community within the region. Additionally, honing and mentoring certain tinkering labs as "Model tinker spaces" will serve as mentoring and guiding labs for newer schools.

6. Setting goals and deliverables

The tinkering lab should have a set of goals and deliverables based on a reasonable model to operate with the existing school curriculum. Furthermore, schools should have a mechanism to track their deliverables and processes.

7. Active Partnerships

Active partners from the local ecosystem, including the local governments; seller and vendor networks; STEM education trainers and other enterprises, can prove to be catalysts for the success of the proposed tinkering labs. The host countries can also develop a fair and transparent seller/ vendor pool for the smooth process of procurement of tinkering lab equipments.

8. Engagement with Mentor States

The host country may enter into handholding agreements with other leading countries for innovative cooperation between the students of host country and other nations with developed STEM education ecosystem.

X. The Way Forward

The tinkering labs can create an environment for young students to think freely, innovate and be problem solvers for their community. The transformation of mindsets, teaching pedagogy, learning and doing should be considered as the eventual impact that this movement will create.

To truly incorporate innovation within any country's education system, it is imperative to parallelly develop an industry-academia linkage ecosystem to foster relevant public-private engagements to ensure sustainability and devoted resources to build a highly motivated and passionate network of teachers & mentors.

Adopting an enduring outcome-based approach is critical for any programmatic intervention to create a substantial impact on the ground. Since the proposed tinkering lab establishment is a national initiative, the overall outcomes must be continuously monitored, and corrective measures must be implemented as and when required.

Tinkering labs are self-directed learning environments. Students develop independence because they are given free will and can choose what and how they learn. Students can make mistakes without the fear of failure. The tinkering labs simulate real-life situations, preparing our kids for life beyond school.

Reference

https://aim.gov.in/atl.php

https://en.wikipedia.org/wiki/Maker_culture

https://tltlab.org/wp-content/uploads/2019/10/2018.Blikstein.Tech-Handbook.Maker-Movement-History-Prospects.pdf

https://www.routledge.com/Design-Make-Play-Growing-the-Next-Generation-of-STEM-Innovators/Honey/p/book/9780415539203

Government of India developed robust mechanism for Online Trading of .... https://pib.gov.in/PressReleasePage.aspx?PRID=1747407

https://aim.gov.in/pdf/ATL_Handbook_2021.pdf

https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

https://aim.gov.in/pdf/SIPHandBook_Digital.pdf

The Mentor India program is a voluntary national movement being led by AIM, wherein skilled professionals provide pro-bono mentoring to young ATL innovators, with a strong sentiment towards nation building (https://aim.gov.in/mentor-of-change.php)

https://aim.gov.in/pdf/ATL-Application_Guidelines-2018.pdf

https://aim.gov.in/pdf/ATL-Tranche-Restructuring-Order-and-Guidelines-260822.pdf
https://aim.gov.in/atl-curriculum.php
https://aim.gov.in/atl-teacher-training.php
https://aim.gov.in/mentor-of-change.php
https://gem.gov.in/
https://pfms.nic.in/NewDefaultHome.aspx
https://atl.aim.gov.in/
https://aim.gov.in/pdf/ATL-Sarthi-Document.pdf

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Efficacy in Chemistry Laboratory Pedagogy Vis-À-Vis the Academic Achievement of Under Graduate Students

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ABSTRACT

The present study aimed to investigate the roles and functions of the chemistry laboratory in accomplishing chemistry-related academic achievement and elevation among the students at under graduate level. The investigator/researchers/authors employed an experimental research design and also used a parallel-group procedure. The sample was randomly selected and it consisted of 100 students of under graduate I year chemistry students. The experiment was conducted in a chemistry laboratory enhancing data collection, mainly focusing volumetric analysis (e. g. acidimetry and alkalimetry) procedure and academic achievement tests. The statistical tools used for data analysis in the study were mean and standard deviation for research questions and t-ratio for testing the null hypothesis at a 0.01 significant level. The findings of the study showed that the laboratory teaching methods had much more effects on science students' academic achievement. The study showed that the boys and girls slightly differ in their performance when taught with the laboratory methods. It means the experimental group is found to be nearly superior to both girls as well as boys in learning chemistry. It also concludes that the effectiveness is also not limited by gender.

Key words: Chemistry education, Laboratory teaching method, Academic achievement.

Introduction

The development and progress of any nation depends on the level of technological achievements of the people made through the learning of science by understanding and exploring its applications. It is viewed generally as a systematic study of nature. Bradford (2015) defined "Science" as a systematic and logical approach in discovering of how things in the Universe work. Thus, the knowledge of science has indispensable link with technology. The authors of the present research stress that the acquisitions of scientific and technological knowledge enhance the student's mental development and achievement in academics.

The laboratory in schools and colleges has been defined by several authors in different ways. Mduabum (1992) sees a laboratory as

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a place where scientific exercises are conducted by the science teachers for the benefit of the students (learners). The laboratory exercises include; conduct of experiments and other activities like demonstrating new experiments, group discussions, conducting science quizzes, one minute presentation on elements, identifying scientists' names by actions and miming, scientific essay writing, creating science-based cartoons etc., which help the students in understanding scientific concepts more effectively. Further, Ezeliora (2001) has defined a science laboratory as a workshop where science is done or where scientific activities are carried out in a conducive environment. She also sees the laboratory as a place where scientific equipments, materials or instruments are housed for security and safety. Interestingly, Igwe (2003) explains that a chemical laboratory can be indoor, such as the sufficiently designed and equipped room found in most schools and colleges or outdoor involving such places as riverside, workshops, fields and even markets for carrying out scientific studies. He further states that whatever the type of laboratory employed in science teaching, the same laboratory experience should be attained, that is participation in the series of experimental, observational and demonstrating activities, which provide an opportunity for the students to develop an understanding of practical and theoretical concepts through solutions of problems.

In focusing chemistry laboratory, students are able to see chemistry hands-on and they have the opportunity to act as scientists and personally observe chemical reactions taking place. It has long been a belief in chemistry education that the science laboratories have the potential to be a place where theory and practice can coalesce for students.

All the activities in chemistry laboratory are connected with chemicals and also chemistry laboratory equipment. Chemistry laboratory equipment means the various tools and equipment used by scientists in the chemistry laboratory. For both experiment and research in chemistry, the laboratory equipments are used. Kinds of chemistry laboratory equipment are laboratory glassware (such as conical flask, beaker, reagent bottle, etc) and analytical device (pH meter, spectrophotometer, magnetic stirrer etc.) [Priymbodo 2017]

Advantages of chemistry laboratory pedagogy

Since school education forms the basic, the main advantages in chemistry laboratory method at school level are discussed below. Undoubtedly, this may extend to college students also.

* Very effective in middle and senior classes
* All students enjoy doing chemistry experiments
* Learning becomes easy
* Students like chemistry labs for the colours of different chemicals.
* All students have fondness for experiments
* Performance of students increases when they learn through labs
* Students learn recording, tabulating and observation skills in lab experiments
* Students enjoy and learn skills
* Students avoid taking leave on practical days

* Students develop scientific temperament
* Girls work neatly in labs compared to boys

1.2 laboratory pedagogy

The main disadvantages in laboratory method are discussed below.

* The problems faced in schools and colleges by the students are handling of chemicals
* Students forget to bring lab coats
* Though goggles are provided students don't like to wear them, they just keep it aside
* Many schools and colleges do not purchase important apparatus like distillation apparatus, Kipps apparatus for H2S gas, enough burners and appropriate apparatus for doing organic based experiments
* School labs should improve a lot, then only teachers can show many more experiments
* Only very dilute acids can be used for experiments
* Many schools do not procure chemicals on time
* In school labs, for metals like sodium, no safety provision is given
* Many schools do not follow lab curriculum prescribed by the Government system They are now making it simple and easy for students
* Many students do practical without learning the names of apparatus
* Conceptually, they do not bother to learn the experiments
* Sometimes schools and colleges do not have lab assistants for different labs. This creates pressure on the only available lab assistant and the teachers too
* Without basics, students perform very badly in Viva-voce examinations

At school level, laboratory approach is liked by all students and chemistry becomes easy and interesting when learnt through laboratory methods. They learn analytical skills also which pave way for higher education, especially research etc.

Need of the laboratory work in chemistry

The need of the laboratory work in chemistry especially in higher education can be divided into three broad areas as given below:

1. **Practical skills -** includes safety hazards, risk assessment, procedures, instruments, observation methods.
2. **Transferable skills -** includes team working, organization, time management, communication, presentation, information retrieval, data processing, numeracy, designing strategies, problem solving.
3. **Intellectual simulation -** connections with the 'real world', raising enthusiasm for chemistry.

The above-mentioned skills are closely interconnected and basically required for a chemistry laboratory pedagogy.

A set of possible reasons for the inclusion of practical work in undergraduate courses in chemistry course is listed below (Reid 2006):

* Illustration of key concepts
* Seeing things for 'real'
* Teaching experimental design
* Reporting, presenting, data analysis and discussion

* Developing deducing and interpreting skills
* Developing time management skills
* Training in specific practical skills and safety
* Developing team working skills
* Enhancing motivation and building confidence
* Showing how theory arises from experimentation
* Developing observational skills
* Introducing equipment

Significance of the study

The most recent concept of teaching pedagogy is to teach the students how to learn, how to discover, how to think and how to inquire. In the fact, every good teacher in the classroom always tries to prepare pedagogy of teaching then he or she wants to follow at all times, when he or she gains more and more experience through the laboratory experiments teaching strategy to the students. The laboratory has been identified as the heart of a good scientific programme which allows students in the school to have experiences that are consistent with the goals of scientific literacy. Therefore, schools and colleges require properly equipped and functional laboratories. The prevalent negative trends in academic output and dispositions of students towards science subjects in general and chemistry in particular have been the concern of science educators and all those who care about the subjects. Several attempts have been made to find out some science teaching methods that can stimulate the students' interest to learn and achieve better in chemistry. In this regard, many researchers have noted that science teachers predominantly make use of ineffective teaching methods in teaching under graduate college chemistry which might have led to deteriorating students' achievement in chemistry. Therefore, there is every need to involve the use of other teaching methods and approaches which have been found effective in some subject areas. One of such is the laboratory teaching method which has proved to be effective in improving students' achievement and interest in chemistry. Therefore, this study sought to find out the efficacy in chemistry laboratory pedagogy on the academic achievement of under graduate college students.

Statement of the problem

Efficacy in chemistry laboratory pedagogy vis-à-vis the academic achievement of under graduate students.

Delimitation of the study

1. The present study will be confined to only under graduate chemistry major students.
2. The study was confined on the topic Volumetric Analysis (ACIDIMETRY AND ALKALIMETRY) Experiment.
3. In this study boys and girls of I year chemistry students were only taken.

Objectives of the study

1. To compare the mean pre-test scores of experimental and control groups.
2. To compare the mean post-test score of experimental and control groups to see the efficacy in chemistry laboratory pedagogy vis-à-vis the academic achievement of under graduate students.
3. To compare the mean post-test scores of boys and girls of experimental groups.

Hypothesis of the study

1. There will no significant difference in the mean pretest scores of experimental and control groups.
2. There will be no significant difference in the mean post-test score of experimental and control groups.
3. There will be no significant difference in the mean post-test score of boys and girls in experimental groups.

Methods and Procedure

Design

In the present study, the investigators used an experimental research design and also used a parallel-group procedure.

Sample

The sample was selected randomly from the following 5 Arts & Science Colleges (Co-Education system) in Madurai district Tamilnadu, India. They are

1. Arul Anandar College
2. M.S.S. Wakf Board College
3. S. Vellaichamy Nadar College
4. Sourashtra College
5. Thiagarajar College

It consisted of 100 students in I year under graduate chemistry course.

Tools

1. Volumetric Analysis (ACIDIMETRY AND ALKALIMETRY) procedure was prepared by the investigators.
2. Academic achievement tests were prepared by the investigators.

Statistical analysis

1. Descriptive statistics such as mean and standard deviation (S. D.) was used.
2. 't' ratio was employed.

Results and Discussion

In order to test that "There will no significant difference in the mean pretest scores of experimental and control groups" raw scores obtained from pre-test and post-test were tabulated and analyzed. 'N' denotes the number of students and 't' value was computed to study the significant difference between mean pre-test scores of experimental and control groups. The results so obtained have been entered in table 1

Table-1: Showing 't' value of mean pre-test scores of experimental and control groups

Group	N	Mean	S.D.	Mean difference (D)	df	t - ratio	Remarks @ 5% level
Control Group	50	11.28	3.169	0.14	98	0.233	NS*
Experimental Group	50	11.14	2.836				

*NS denotes non significance @ 5% level

Table 1 reveals that the mean pre-test scorers of control and experimental groups are 11.28 and 11.14 respectively. The obtained 't' value (t = 0.233) is not significant at 0.01 level, which shows that there exists no significant difference in the achievement of students in the chemistry of experimental and control groups.

The mean pre-test scores of experimental and control groups are 11.28 and 11.14 respectively and their mean difference

(D) is 0.14, which reveals that the performance of students in both the groups i. e., experimental and control groups do not differ in the pre-test scores.

Thus, the first hypothesis namely "There will no significant difference in the mean pretest scores of experimental and control groups" is accepted.

In order to test that, "There will be a significant difference in the mean post-test score of experimental and control groups" the following analysis is done.

Table-2: Showing 't' value of mean post-test scores of experimental and control groups

Group	N	Mean	S.D.	Mean difference (D)	df	t- ratio	Remarks @ 5% level
Control Group	50	15.86	3.044	4.70	98	5.815	S*
Experimental Group	50	20.56	4.837				

*S denotes significance @ 5% level

Table 2 reveals that the mean post-test scores of the control and experimental groups are 15.86 and 20.56 respectively. The obtained 't' value (t = 5.815) is significant at 0.01 level, which shows that there is a significant difference (S) in the achievement of students in the chemistry of the experimental and control groups.

The mean post-test scores of the experimental and control groups are 15.86 and 20.56 respectively and their mean difference (D) is 4.70, which reveals that the group taught with the laboratory method has higher mean post-test scores as compared to the group taught with the conventional method. It means that students taught with the laboratory methods showed better performance than the students taught with the conventional method.

Thus, the second hypothesis namely "There is no significant difference in the mean post-test scores of experimental and control groups" is not accepted.

In order to test that, "There will be no significant difference in the mean post-test score of boys and girls in experimental groups" the following analysis is done.

Table-3: Showing 't' value of mean post-test scores of experimental groups

Gender	N	Mean	S.D.	Mean Difference (D)	df	t- ratio	Remarks @ 5% level
Boys	25	20.12	5.028	0.88	48	0.639	NS*
Girls	25	21.00	4.699				

*NS denotes non significance @ 5% level

Table 3 reveals that the mean post-test scores of boys and girls are 20.12 and 21.00 respectively and the mean difference (D) is 0.88. Calculated 't' value (t = 0.639) is not significant at 0.01 level, which clearly shows that boys and girls do not differ significantly in their mean post-test scores when taught through the laboratory method. It means that the experimental group is found to be nearly equally superior for both boys and girls in learning chemistry.

Therefore, the third hypothesis "There will be no significant difference in the mean post-test score of boys and girls in experimental groups" is accepted.

Findings

In the light of the above-mentioned interpretation and discussion, the following conclusions have been drawn:

1. The performance of students in both the groups i.e., experimental and control groups do not differ in their pre-test.
2. The performance of students in mean post-test scores of experimental groups i.e., with the laboratory method is higher than the mean post-test scores of control group i.e., with the conventional method.
3. The boys and girls slightly differ in their performance when taught with the laboratory method. It means experimental group is found to be nearly superior to both girls as well as boys in learning chemistry.
4. The students of the experimental group were looking well motived and ready to learn students of the control group.

Final thoughts

All of the practical chemistry courses should be taught in the laboratory, with all of the appropriate equipment and reagents. The pupils would gain knowledge using the chemicals/reagents. Handling harmful substances necessitates a set of abilities and skills. In their teaching and learning processes, both teachers and students are involved. This will assist them in learning new concepts, approaches, and abilities in challenging chemistry. The study shows that the laboratory method approach plays an important role in improving the academic achievement of students. So, the teacher should use the laboratory method approach in teaching in the classroom which can make his/her task easier and students can achieve better.

Students may even find themselves participating in novel research exercises during scheduled laboratory teaching. This study identifies and highlights a good and innovative trend that ensures student engagement and an improved learning experience in the chemistry laboratory pedagogy.

We should not forget the saying "what I hear I forget, what I see I remember, what I practice I understand" may be the key for students for a successful outcome of their efforts.

Despite all the technological advancements, we shouldn't forget traditional lab training entirely:

"Not because that is the way we want to continue to do chemistry rather because we want to build a better way of doing chemistry in the future."

"We want our students who want to learn a particular technique to do it in the authentic setting."

References

Bradford. A., (2015), Science and the Scientific Method: A Definition Journal of Live Science Contributor. Retrieved from http://www.livescience.com/20896-science-scientific-method.html November 2016.

Ezeliora. R., (2001), A guide to practical Approach to Laboratory management and safety precautions. Daughters of Divine love congregations: Enugu: Divine Love Publishers.

Igwe, I.O., (2003), Principles of science and science teaching in Nigeria (An introduction). Enugu: Jones Communication Publishers.

Mduabum, M. A., (1992), Teaching Biology effectively, (2nd Edition). Owerri: Whyte and White Publishers.

Priyambodo. E, Wiyarsi. A, Dina, Nugraheni. A.R.E., (2017), Chemistry Laboratory Equipment Inventory Media: An Alternative Media for Students' in Learning of Laboratory Management (3), http://seminar.uny.ac.id/isse2017

Reid. N & Shah. I., (2007), The role of laboratory work in university chemistry. Chemistry Education Research and Practice, 8(2), 172-185.

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Time Management Competency among Higher Secondary School Students in Puducherry

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ABSTRACT

Time management is a set of skills and methods that one uses to manage time when completing a specific work in the span of time. This set encompasses a wide scope of activities, and these include planning, allocating, setting goals, delegation, analysis of time spent, monitoring, organizing, scheduling, and prioritizing.

The present study focuses on the time management competency skills among higher secondary school student in Puducherry. A sample of 251 higher secondary school student were selected for the study. Time management competency scale by D. Sansanwal and Meenakshi Parashar was employed for the study.

Findings reveal that there is direct relationship between time management competency and academic achievement of the higher secondary. Background variables like gender and locality doesn't influence time management skills whereas standard of study influences time management competency among higher secondary school students.

Key words: time management competency, higher secondary school students.

Introduction

Time is to be deemed very substantial to human beings as age and capital; especially that entire human life is made of time segments which mean the second that is gone is going to shorten the human life and make the death nearer. The whole life is a test to see who deserves the paradise in the judgment day, so exploiting the time to fulfill ambitions is of great importance in both worldly life and in the hereafter (Algaradawi, 2003, p14).

This skill is a very worthwhile issue during to being it a key factor in any success at all levels of life and for that the term time management is strongly associated with administrative work. Despite of its importance, it is never an easy task to manage time individually and a need to specific qualifications along with many personal skills is then a must. Let alone exploiting the available resources in order to meet the society and individual needs at the same time and the ability to adjust with the present and future situations (Alghamdi, 2008, p 49).

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To manage time is another sense of distributing priorities and exert efforts upon that distribution, according to Covey (2004) seven matters a person must give priorities for, as namely; improving the contacts with others, preparing the activities more effectively, improving the process of managing and planning for the duties, caring for the personal interests, seizing new opportunities, improving the personal skills and information, admitting the power of others.

Time management is an important skill students has to follow to effectively complete tasks. Hence in the present study is aimed to time management competency among school students.

Statement of Problem

The present study is "Time Management Competency among School Students in Thiruvannamalai District"

Objectives of the Study

The following are the objectives of the study:

1. To study the significant relationship between the time management competency and academic achievement among higher secondary school students.
2. To study the significant mean difference between the time management competency among higher secondary school students with respect to the back ground variables gender, locality, standard of study.

Sample of the Study

The present population is 251 higher secondary school students from Puducherry town.

Tools Used in the Present Study

This tool time management competency scale was constructed by D.N. Sansanwal and Meenakshi Parashar at Indore. Time management competency scale was developed to help people to know the extent to which they can manage the available time efficiently. This tool consists of 36 statements. The test- retest reliability coefficient was found to be 0.72 while split-half reliability coefficient was found to be .96.

Analysis and Interpretation

From table 1, It is found that there is significant relationship between the time management competency and academic achievement among higher secondary school students.

Table-1: showing the correlation coefficient between the time management competency and academic achievement

Independent variable	Dependent variable	r- value	Result
Time management competency	Academic achievement	.631	Significant

With respect to the background variables namely gender, locality and standard of study, it is found that the gender and locality doesn't have influence over the time management competency as the obtained t value is less than the table value. Whereas, the obtained t value (Table-2) for the standard of study is above the table value and hence it influences time management competency.

Table-2: Showing the Mean, standard deviation and 't'- value of the time management competency with respect to the male and female higher secondary school students.

Dependent variable	Groups	N	Mean	S.D	t-value	df	Level of Significance at 0.05
Time management competency	Male	103	116.06	10.44	.619	249	Not Significant
	Female	148	115.35	7.64			
	Rural students	167	115.40	8.37	.618	249	Not Significant
	Urban students	84	116.13	9.85			
	11th students	160	116.54	9.85	2.149	249	Significant
	12th students	91	114.05	6.56			

Findings of the Study

Following are the findings of the present study:

1. There is significant relationship between the time management competency and academic achievement among higher secondary school students.
2. There is no significant mean difference between the time management competency among male and female higher secondary school students.
3. There is no significant mean difference between the time management competency among rural and urban higher secondary school students.
4. There is significant mean difference between the time management competency between among 11th and 12th students.

Educational Implications of the Study

By studying about the time management competency of the higher secondary school students it is found that the skills like planning, organizing, leading and evaluating plays an important in the time management skills of the higher secondary school students. Hence student must be given training in the on the different ways to plan, organize, lead and evaluate their time utility. Thus by learning these skills, they can apply it

Recommendations of the Study

Following are the recommendation of the study:

1. Present school curriculum could revised by adding time management competency skills.
2. Training session on time management competency skills could be developed and utilized.
3. Test anxiety could be avoided in students if they utilize their time management competency skills effectively.

References

Agarwal J.C., (1989). Education in Indian policies, programmes and development, 2ed., Doba house Publishers, New Delhi, pp. 112-115

Anil. R and Sholy Joseph, (2000). A study of interest in teaching of teacher trainees undergoing B.Ed., course in Kannur university, Experiments in Education, Vol. XXXVIII, No.Pp.21-28

Bharat Joshi and jagdish ramanuj, (1997). A study research questions in Indian Teaching Education, University News, Vol.35, No.7, Pp. 12-14.

Bhatnagar, T.N.S. (1980). Studies and literature on student teaching and practical work in B.Ed programme in India - A review. Department of teacher education, NCERT in M.Buch (Ed)

Colette Laborde. (2005). Time Management in the Work Economy of a Class, a Case Study: Integration of Cabri in Primary School Mathematics Teaching. Springer US

Debnath. H.n. (1971). Teacher efficieny its measurement and some determinansts. Ph.D thesis., Vishwabharathi University.

Delors, J. (1996). Learning: the treasure within. Report to UNESCO of the international Commission on Education for the twenty first century, Paris, UNESCO.

Jayamma. M.S., (1962). Construction and standardization of the inventory for the primary school teachers of Mysore state, Ph.D., Thesis, Mysore University.

Joshi and kamakshi, (1994). Reaction of trainees towards an innovative teacher education programme, Prospective in Education, Vol. 17, No.4, Pp. 207-218

Kasinath. H.M., (1995). Student teaching for virtuoso performance - a Chinese model, New frontiers in education, Vol. XXV, No.1, pp.44-51.

Kothari, R.G and Shah, A.H, (1997). Teacher Education at secondary level -some observations. New frontiers in education, Vol. XXV, No.1, pp. 241-247

Marsh and Wilder, (1954). Supervisory management: a short course in supervision, Jhon Wiley and Sons, inc.

Mark Trueman. (2004). A comparison between the time-management skills and academic performance of mature and traditional-entry university students. Springer Netherlands.

Mediley and Mtzel, (1963). Teacher effectiveness and learning, Sanders publications.

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A Study of the Impact of the Use if E-Learning on Secondary School Students

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ABSTRACT

The present study is survey type quantitative nature. The objectives of the study as: (1) To construct the Use of E-Learning Inventory on Secondary School Students and (2) To Study of the Impact of the Use of E-Learning on Secondary School Students. The students studying in Gujarati medium Secondary Schools in Gujarat was considered as population of the study. The investigator were selected 90 secondary school students studying at Rajkot as sample in which 45 boys and 45 girls. Survey type quantitative was used. In the present study the investigator constructed standardized Use of E-Learning Inventory on Secondary School Students was used. Use of E-Learning Inventory was administered on Secondary School Students. The student's scores on the E-Learning Inventory were recorded. This quantitative study the data were analyzed by descriptive statistical technique mean and SD. The study revealed that Electronic learning or 'e-learning' has been an influential mode of learning today. Based on this study, it can be concluded that the students were exposed to the e-learning in great deal. This study has also proven that e-learning could provide greater flexibilities on instructor-led or self-study courses among the students.

Key words: e-learning.

Introduction

Teaching is a dynamic, well-planned and systematic presentation of facts, ideas, skills and techniques to students and its focus is to acquire maximum learning experiences. Selection of the most suitable teaching strategies is the basic condition for successful teaching/learning process. E-learning or electronic learning is used to provide instructional programmes to students who are separated by distance and from the instructors or teachers. It uses the Internet, computers, networking and multimedia technologies. There are many definitions of e-learning. According to Garisson and Anderson (2003), as cited in Muhammad Rais and Yusup Hashim (2004), e-learning is a network or online learning that takes place in a formal context and uses a range of multimedia technologies. Chan et al. (2007) highlighted that e-learning includes computer-enhanced learning or

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training which is usually delivered via a personal computer. Learning is delivered by other communication technologies whose methods of delivery include online lectures, tutorials and learning support systems. Effective e-learning is often a blend of methods. It also includes online learning, web based training and computer based training. E-learning may improve access to education and training, the quality of teaching and learning and mark the need for higher institutions to maintain competitive advantage in this changing market place for students. This means e-learning may enhance quality of teaching and learning. There are numerous advantages and disadvantages of e-learning. Previous research found that e-learning is more cost effective than traditional learning because less time and money is spent by learners on travelling. This means when students embark on e-learning, they can be thrifty. Besides, flexibility is another major benefit of e-learning. E-learning provides learners the advantage of taking classes anytime and anywhere.

Review of Literature

E-learning is the acquisition and use of knowledge distributed and facilitated primarily by electronic means. This form of learning currently depends on networks and computers but will likely evolve into systems consisting of a variety of channels (e.g., wireless, satellite), and technologies (e.g., cellular phones, PDA's) as they are developed and adopted. e-learning can take the form of courses as well as modules and smaller learning objects. elearning may incorporate synchronous or asynchronous access and may be distributed geographically with varied limits of time. Some terms are: e-learning, distributed learning, online learning, web-based learning and distance learning. First, to review and summarize definitions related to e-learning. Urdan & Weggen (2000), related that online learning constitutes just one part of e-learning and describes learning via internet, intranet and extranet. They added that levels of sophistication of online learning vary. Hall and Snider (2000) define e-learning as the process of learning via computers over the Internet and intranets. Hall and Snider extended that e-learning is also referred to as web-based training, online training, distributed learning or technology for learning. Given the progression of the definitions, then, web-based training, online learning, e-learning, distributed learning, internet-based learning and net-based learning all speak of each other (Hall & Snider, 2000; Urdan & Weggen, 2000). Similar also to e-learning and its related terms is technology-based learning (Urdan & Weggen 2000). Urdan & Weggen shared that e-learning covers a wide set of applications and processes, including computer-based learning, web-based learning, virtual classrooms, and digital collaborations. Like Hall & Snider 2000), Urdan & Weggen (2000) have set apart distance learning and e-learning in their glossaries, making, however, e-learning inclusive and synonymous to all computer-related applications, tools and processes that have been strategically aligned to value-added learning and teaching processes. Berge (1998) explained the difference between distance education and distance learning. Distance education was seen as the formal process of distance learning, with information being broad in scope, for example, college courses. While, distance learning was seen as the acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance. Willis (1994) in his definition of distance learning identified the acquisition of knowledge and skills as another criterion and supported the former three criteria by saying that distance learning occurred through mediated information and instruction, and encompassed all technologies and other forms of learning at a distance. Interestingly, Urdan & Weggen (2000) saw e-learning as a subset of distance learning, online learning a subset of e-learning and computer-based learning as a subset of online learning. Distance learning purports planned courses, or planned experiences.

Objectives of the study

Objectives of the study were:

1. To construct the Use of E-Learning Inventory on Secondary School Students.
2. To Study of the Impact of the Use of E-Learning on Secondary School Students.

Variables involved in the study

Two types of variables were involved the study: (1) Independent variable and (2) Dependent variable.

Independent Variable: The independent variable of present study was students. Two level of Boys and Girls.

Dependent Variable: The dependent variables of present study were student's Scores of Use of E-Learning Inventory.

Research Question of the study

With reference to objective the research question as:

To Study of the Impact of the Use of E-Learning on Secondary School Students.

Population & sample

The students studying in Gujarati medium Secondary Schools in Gujarat was considered as population of the study. The investigator were selected 90 secondary school students studying at Rajkot as sample in which 45 boys and 45 girls.

Tool of the study

In the present study the investigator in order to trace out in Use of E-Learning Inventory on Secondary School Students was prepared by investigator himself. They were Use of E-Learning Inventory on Secondary School Students was divided to two sections. Section - I requested for the background information of the students and section - II was the Use of E-Learning Inventory on Secondary School Students consists of (9) items, each rated on five -point Likert scale running from (1 = Strongly disagree , 2 = Disagree , 3 = Undecided, 4 Agree, and 5 = Strongly Agree). For this study, experts in the field ensured face and content validity of the items through consultation. The scores were reversed for negatively worded items. It was given to colleagues for content and construct validity. The reliability of the used tools is verified and established. Through the split half method the reliability coefficient of Use of E-Learning Inventory on Secondary School

Students was 0.87 and by Spearman brown method it was 0.85. The internal consistency of the tool was established using Cronbach Alpha which yielded a reliability index of 0.89 (Cronbach, 1951). The tool was pilot tested and the Kuder-Richardson 20 reliability index was 0.78 (Kuder & Richardson 1937).

Data collection

Use of E-Learning Inventory was administered on Secondary School Students. The student's scores on the E-Learning Inventory were recorded.

Statistical Technique used of analysis of the data

This quantitative study the data were analyzed by descriptive statistical technique mean and SD.

Results and discussion

The results of Mean and SD of the Use of E-Learning Inventory on Secondary School Students are presented in Table-1.

Table-1: Mean and SD of the Use of E-Learning Inventory on Secondary School Students

Nos.	Statement	Mean	S.D.
1.	E-learning can enhances my computer and Internet skills.	4.29	0.75
2.	E-learning can give more advantages rather than disadvantages to my academic achievement.	4.36	0.67
3.	E-learning gives no time barrier.	4.33	0.73
4.	E-learning helps me to make my lesson more organized.	4.11	0.64
5.	E-learning helps my lesson more effective compare to chalk and talk.	4.00	0.64
6.	E-learning provides complete content in my learning with good exercise.	4.27	0.72
7.	E-learning provides good instructional learning program to me even I far from teacher.	4.27	0.75
8.	E-learning provides me with different learning styles and can make my learning more fun.	4.09	0.63
9.	E-learning provides me with greater flexibility on free to select either instructor-led or self-study courses.	4.49	0.69

Based on Table -1, with the highest mean score of 4.49 and Standard Deviation of 0.69, the students admitted that E-learning had provided them with greater flexibilities on either instructor-led or self-study courses. Chan et al. (2007) stated that one of the benefits of e-learning to students is that it can cater a wide range of students learning styles. Fioriello (2009) stated that students have an option to choose what they like and e-learning draws them to topics they like and enjoy. From the researcher's point of view, the students had the autonomy to choose the types of e-learning tools they preferred to use. Usually, students choose the Internet as their main e-learning tools and CDROM as their second preferred choices. This happens because students nowadays could get easy access to the Internet since they have the connection at home (39.82%). Having the Internet is important since it could provide them current knowledge and practices. The lowest mean score was seen in the statement 'E-learning helps me understand my lesson effectively compared to the chalk and talk method' (mean: 4.00, SD: 0.640). This is not surprising considering that e-learning contains colorful pictures and interesting videos that can make students enjoy learning. Liam and Huang (2002) as cited in Borstorff and Lowe (2007) found that websites, a diversity of multimedia inputs such as video, audio, photos and online chat rooms, had allowed the learners in their study to seek knowledge that would relate to their prior, personal experiences and engage them in interdisciplinary training. According to Chan et al. (2007), previous studies showed that online learning could provide a variety of delivery methods to cater to different types of learners if compared to traditional classrooms. Besides, from the perspective of Bloom's Taxanomy, e-learning is an effective learning tool (Kartha, 2006, Suanpang and Petocz, 2006, Vidakovic et al. 2003, in Halawi et al. 2009). In my opinion, e-learning could provide interesting learning styles and enhance students' academic performances. Students can be more active because they could learn independently and increase their thinking abilities. Students can have systematic lessons because e-learning provides content and exercises displayed in videos, animations and sounds.

Conclusions

Electronic learning or 'e-learning' has been an influential mode of learning today. Based on this study, it can be concluded that the students were exposed to the e-learning in great deal. This study has also proven that e-learning could provide greater flexibilities on instructor-led or self-study courses among the students.

References

Borstorff, P.C. & Lowe, S.K. (2007) Students Perceptions and Opinions Toward E- learning in the College Environment. Academy of Educational Leadership Journal, 11 (2), 13-29. Retrieved March 25, 2010 from http://www.alliedacademies.org/Publications/Papers/AELJ%20Vol%2011%20No%202%202007%20p%2013-29.pdf

Chan Y. F., Ranjit K.S., Jamiah Baba & Eliza Parman. (2007). Computer Education ForClassroom Teaching. Malaysia: McGraw-Hill Fauzi Jasmani. (2011). Ketagih Internet punca otak remaja mengecut?. Retrieved January 4, 2012 from http://eiz1004.upprofits.com/ketagihinternet-punca-otak-remaja-mengecut/

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16 (3): 297-334.

Fioriello, P. (2009). 14 Advantages of E-learning. Retrieved January 4, 2012 from http://drpfconsults.com/14-advantages-of-e-learning/

Hafizah Mohamad Hsbullah & Kamil Md. Idris. (2009) E-learning adoption: the role of relative advantages, trialability and academic specialization. Campus Wide Information System, 26 (1), 54-70. Retrieved March 10, 2010, from http://proquest.umi.com.ezaccess.library.uitm.edu.my/pqdweb?index=6&did=1615587031&SrchMode=1&sid=4&Fmt=6&VInst=PROD&V

Halawi, L.A., Mccarthy, R.V & Pires, S. (2009) An Evaluation of E-learning on the Basis of Bloom's Taxonomy: An Exploratory Study. Journal of Education for Business, 84 (6), 374-380. Retrieved March 25, 2010, from http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=EJ844509&ERICExtSearch_SearchType_0=no&accno=EJ8445090

Kuder, G. F. & Richardson, M. W. (1937). The theory of the estimation of test reliability. Psychometrika, 2(3), 151-160.

Muhammad Rais Abdul Karim & Yusup Hashim.(2004). The experience of the E-learning implementation at the Universiti Pendidikan Sultan Idris, Malaysia. Malaysian Online Journal of Instructional Technology (MOJIT), 1 (1), 50-59. Retrieved March 10, 2010, from:http://pppjj.usm.my/mojit/articles/pdf/0804/The%20Experience%20of%20the%20E-Learning%20Implementation%20at%20UPSI.pdf

Shelly, G.B., & Vermaat, M.E. (2008). Discovering Computers 2009, USA: Course Technology Cengage Learning

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Exploring the Impact of Fun-Based Pedagogy in Mathematics to Achieve the Learning Outcomes at Preparatory Stage

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ABSTRACT

Due to the prolonged closure of schools during the COVID 19 pandemic, there was no direct learning with the children. It has affected children's learning in two ways. On one hand, the learning of something new in regular mathematics was not only hindered but stopped. On the other hand, due to lack of regular schooling and lack of new learning and practice, they have forgotten much of what they had learned earlier. Some of the root causes are societal attitudes towards mathematics, the nature of the subject and the way it is taught. SCERT Uttarakhand designed and implemented a Bridging Curriculum approach to improve the learning outcomes of the students at Grade Level as well as the prior learning outcomes which the students couldn't achieve in earlier grades. For this purpose, a sample of 225 students of Class 4th and 5th has been assessed on six learning outcomes of Mathematics. An assessment based on these learning outcomes had been administered in the fourth week of July throughout Pauri District and compared with the Half Yearly Assessment held in the fourth week of October.

Key words: Learning Outcomes, Bridging Curriculum, Spiral Approach, Achievement, Assessment

Introduction

From the end of year 2019, Covid-19 started engulfing the world. This pandemic had affected all the processes. Due to this, the educational processes were also badly affected, due to which not only the learning of the children had been lost, along with it the learning had also been lost. There was a need to make some special efforts to make up for the loss in learning of children and to inculcate classroom-appropriate reading skills. It was very important to work in a planned manner to make these special efforts. To overcome this crisis that had arisen in education, we had to prepare our action plan keeping in mind the current circumstances, so that we can improve the learning of children. Schools across the country were closed for nearly 18 months, with partial reopening slated for late 2021. During

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this time online mode of education was attempted in school education, but access to education could not be facilitated for most of the children from disadvantaged groups mainly due to lack of internet connectivity and high cost of equipment. Even in cases where access to resources was not a problem, online learning proved to be nearly as ineffective as compared to physical learning.

Now the schools had opened again. It was essential that the actual loss of learning in respect of each student was assessed by their teachers. Meanwhile, all these students had promoted to the next classes, where the level of expectations regarding learning competencies had become even higher. So the whole education system was now facing the challenging task of how to plan the teaching-learning process further. Where a student studying in class 3 found himself in class 5, but whose level of abilities is at par with a student in class 2. Looking at the learning curve, these abilities were also acquired by this child before the lockdown began. Therefore, to solve it, it was necessary that a thoughtful and planned approach is adopted at the levels of both the education system and teachers.

During the 18 months of school closures due to the COVID-19 pandemic, children had faced life-threatening impacts-deaths in the family, loss of dignity by parents, malnutrition, domestic violence, loss of learning opportunities, and more. There were some examples. Many children at this age had not even experienced collaborative learning anywhere that gave importance to the expression of their individual experiences. Any effort towards educational processes without understanding their emotional state and their readiness to learn will be futile. Hence teachers need to connect with the students on a personal level to understand what kind of support they need. The timing of the onset will be very important for teachers in attempting to assess academic skills and understanding the extent of the damage.

The easiest way to focus on the socio-emotional needs of children is by giving due importance to all kinds of co-curricular activities in the school. The arts and physical education are known to promote socio-emotional well-being and understanding among people of different cultures. Art lays stress on the free and open expression of thoughts and ideas. It helps individuals to reflect on their own experiences in creative ways, to share them with their peers, and as a result to gain empathy and appreciation for each other.

About 1.6 billion children worldwide, including around 250 million in India, suffered school closures during the Covid-19 pandemic. The impact of school closures is now being better understood through National Achievement Survey (NAS). About 3.4 million students in 118,000 schools in 720 rural and urban districts were surveyed for NAS in November 2021. In Uttarakhand, the students of class 3 scored 330 (in scaled scores out of 500) in 2017, but the same has now reduced to 291. Around 70 per cent of the students were found to be in the basic or below basic category in Mathematics. Some of the root causes are societal attitudes towards mathematics, the nature of the subject and the way it is taught (Kunwar, 2020; Vogt et al., 2018, Mannone, 2019). In the broad subject matter of mathematics, to understand any higher concepts, it is very important to understand its basic concepts (SCERT Uttarakhand, 2022). Therefore, a sound plan of teaching in Mathematics demands the ability to visualize concepts and their interrelationships. It is always a matter of concern that Mathematics is dominated by rote learning of formulas and topics, rather than conceptual understanding. All these circumstances have created an unprecedentedly challenging situation in terms of student learning (Sajeevan et al., 2022; Singh, 2022; Pai, 2021). To deal with this situation, it is necessary to have a concrete action plan so that every child can achieve grade level learning outcomes.

Objectives behind the Strategy

To work on current grade's proficiency along with last two grades (apart from basic numeracy), this strategy was designed keeping in mind the following objectives -

* Establishing consistent grade-wise sequencing of required learning outcomes.
* Determination of class-wise content based on the required learning outcomes.
* Mapping the steps for classroom content learning based on the required learning outcomes.
* Suggestive teaching process to effect required learning outcomes.

Scope to compensate for learning loss

As an action plan to bridge this loss in learning, a one-time clinical assessment of the students should be done. After clinical assessment of the students, the teacher/ teachers may choose to -

* To work on 'Basic Number Knowledge' based on the needs of the students of each class.
* If the teacher feels that the children have developed an understanding of 'Basic Number Sense' then an attempt can be made to work with the student on further 'Essential Learning Outcomes'.

Learning outcomes related to Foundational Numeracy have also been linked to grade-wise expected progression and level taking into account the learning loss during COVID. The learning outcomes prescribed by NCERT are very important for that age group, but keeping in view the loss due to COVID it is also not possible for every class to work on all the learning outcomes of that class simultaneously. It is necessary to work by selecting some of the most important results. Learning outcomes related to Foundational Numeracy have also been linked to grade-wise expected progression and level taking into account the learning loss during COVID. The learning outcomes prescribed by NCERT are very important for that age group, but keeping in view the loss due to COVID it is also not possible for every class to work on all the learning outcomes of that class simultaneously. It is necessary to work by selecting some of the most important learning outcomes.

There is a need to work on logically linking the learning outcomes of the present class with the learning outcomes of the previous two classes to compensate for the loss of learning due to non-functioning of classes in the last two years. The reasons for the selection of some of the essential learning outcomes can be better understood with the help of the following points -

* Some learning outcomes are introduced to children in one class early and discussed in more detail in another class. For example, the verbal representation of a fraction is taught in detail directly in class 5 instead of class 4. Similarly, learning outcomes related to clocks can also be dropped in class 4.
* The learning outcomes provided in some of the classes can also be used to achieve some of the missing learning outcomes of the previous classes such as children can also develop essential spatial understanding while studying geometry.

Keeping in view the time constraints, priority should also be given to those learning outcomes which are related to basic number sense and operations (Foundational Numeracy).

As soon as the schools opened in April 2022, the teachers started working with the students as per their standard curriculum, but they soon realized that the children are still struggling with basic competencies. Seeing this problem, they started doing some work with the children on numbers and operations, even after working for a month; they felt that there was no visible change in the classroom challenges (Sajeevan et al., 2022; Singh et al., 2022). He felt very bad seeing that they are trying so much from their level but the children were not able to learn. They shared their pain with the teachers in their contact area, in which some of them came out with the following reasons (SCERT Uttarakhand, 2022)-

* In two years the children have forgotten everything.
* There are weak children as soon as they come to us, their parents do not pay any attention to them?
* They don't have any resources so how will they learn? Most of the time is spent in office communications. Books do not reach the children in time, how will you teach them?
* When there is no fear about studies, will it be like this only? We don't have enough time to do anything. How will it come? Student is coming school after three years. How will the one who was in 3rd Grade learn about 6th Grade?

We got to hear many more such answers. After listening to all these reasons, we understood that almost all the teachers whom we talked are also facing the same problems. In Jun - July 2022, SCERT Uttarakhand organized a workshop to design a curriculum for at least a session which can cater the needs of the students in such a way that it can bridge the learning gap (as most of the students couldn't achieve the prior grade's Learning Outcomes). The curriculum in Mathematics for Primary Grades was designed with four basic guiding principles -

* **Thematic Approach -** Teaching with theme based learning outcomes of individual classes rather than working on class wise learning outcomes

* **Interrelated Concepts' Clusters -** Teaching by creating clusters of concepts that have clear interrelationships
* **Multi Utility Activities -** Make changes to the selected activities in such a way that the learning outcomes of individual classes are addressed
* **Multi Utility Teaching Learning Materials -** Prioritizing TLMs that are helpful in teaching different concepts

Objectives of the Study and Research Methodology

The present study explores the performance of students in Mathematics before and after implementation of Bridging Curriculum in teaching learning processes. For the purpose, a representative sample of 225 Primary School Children (15 Students from each block of Pauri District) of Grade 4th and 5th has been reviewed/ observed on the following six learning outcomes (LOs) which was supposed to be attained in July to October 2022 (NCERT, 2017)-

* Solves simple daily life problems using addition and subtraction of three digit numbers.
* Constructs and uses the multiplication facts (tables) of 2, 3, 4, 5 and 10 in daily life situations
* Explains the meaning of division facts by equal grouping/sharing and finds it by repeated subtraction
* Creates and solves simple real life situations/ problems including money, length, mass and capacity by using the four operations
* Identifies half, one-fourth, three-fourths of a whole in a given picture by paper folding and also in a collection of objects.
* Explores the area and perimeter of simple geometrical shapes (triangle, rectangle, square) in terms of given shape as a unit.

Analysis and Discussion

Before implementation of the Bridging Curriculum, it has been explored that 14.3% students could solve simple daily life problems using addition and subtraction of three digit numbers, 20% students have partially solved the problems, whereas 65.7% students wrongly attempted such problems. 11.4% students could construct and use the multiplication facts, 25.7% students have partially solved the problems, whereas 62.9% students wrongly attempted such problems. 22.9% students could explain the meaning of division facts by equal grouping, 28.6% students have partially solved the problems, whereas 48.5% students wrongly attempted these types of problems. 14.3% students could create and solve simple real life problems including money, length, mass, capacity etc., 37.1% students have partially solved the problems, whereas 48.5% students wrongly attempted such problems. 14.3% students could identify half, one-fourth, three-fourths of a whole in a given picture, 28.6% students have partially solved the problems, whereas 57.1% students wrongly attempted such problems (Table 1).

Table-1: Students' performance in Formative Assessment held on 27-28 July 2022

Learning Outcomes (LOs)	Before Implementation of Bridging Curriculum (No. of students)			Total
	Correct	Partially Correct	Wrong	
Solves simple daily life problems using addition and subtraction of three digit numbers	32	45	148	225
	14.3%	20%	65.7%	100.0%
Constructs and uses the multiplication facts (tables) of 2, 3, 4, 5 and 10 in daily life situations	26	58	141	225
	11.4%	25.7%	62.9%	100.0%
Explains the meaning of division facts by equal grouping/sharing and finds it by repeated subtraction	52	64	109	225
	22.9%	28.6%	48.5%	100.0%
Creates and solves simple real life situations/ problems including money, length, mass and capacity by using the four operations	32	83	110	225
	14.3%	37.1%	48.5%	100.0%
Identifies half, one-fourth, three-fourths of a whole in a given p icture by paper folding and also in a collection of objects	32	65	128	225
	14.3%	28.6%	57.1%	100.0%
Explores the area and perimeter of simple geometrical shapes (triangle, rectangle, square) in terms of given shape as a unit	52	38	135	225
	22.9%	17.1%	60%	100.0%

Further, 22.9% students could explore the area and perimeter of simple geometrical shapes, 17.1% students have partially solved the problems, whereas 60% students wrongly attempted such problems.

After implementation of the Bridging Curriculum, we explored that 45.7% students have solved simple daily life problems using addition and subtraction of three digit numbers, 42.9% students have partially solved the problems, whereas 11.4% students wrongly attempted such problems. 48.6% students have constructed and used the multiplication facts, 37.1% students have partially solved the problems, whereas 14.3% students wrongly attempted such problems. 40% students have explained the meaning of division facts by equal grouping and found the values using repeated division, 42.9% students have partially solved the problems, whereas 17.1% students wrongly attempted these types of problems. 34.3% students have created and solved simple real life problems including money, length, mass, capacity etc., 42.9% students have partially solved the problems, whereas 22.9% students wrongly attempted such problems. 54.3% students have identified half, one-fourth, three-fourths of a whole in a given picture, 25.7% students have partially solved the problems, whereas 20% students wrongly attempted such problems (Table 2).

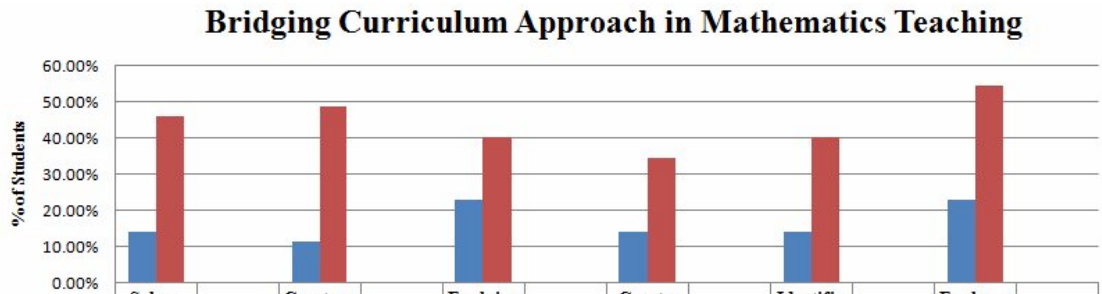
Table-2: Students' performance in Formative Assessment held on 21-22 November 2022

Learning Outcomes (LOs)	After Implementation of Bridging Curriculum (No. of students)			Total
	Correct	Partially Correct	Wrong	
Solves simple daily life problems using addition and subtraction of three digit numbers	102	97	26	225
	45.7%	42.9%	11.4%	100.0%
Constructs and uses the multiplication facts (tables) of 2, 3, 4, 5 and 10 in daily life situations	110	83	32	225
	48.6%	37.1%	14.3%	100.0%
Explains the meaning of division facts by equal grouping/sharing and finds it by repeated subtraction	90	97	38	225
	40%	42.9%	17.1%	100.0%
Creates and solves simple real life situations/ problems including money, length, mass and capacity by using the four operations	77	96	52	225
	34.3%	42.9%	22.9%	100.0%
Identifies half, one -fourth, three-fourths of a whole in a given picture by paper folding and also in a collection of objects	90	103	32	225
	40%	45.7%	14.3%	100.0%
Explores the area and perimeter of simple geometrical shapes (triangle, rectangle, square) in terms of given shape as a unit	122	58	45	225
	54.3%	25.7%	20%	100.0%

Further, 54.3% students could explore the area and perimeter of simple geometrical shapes, 25.7% students have partially solved the problems, whereas 20% students wrongly attempted such problems.

Conclusion

In this study it has been explored that there was less accuracy in attempting the Mathematics problems among 4th and 5th graders. It is quite evident from the graph that the performance of the students has been improved after implementation of Bridging Curriculum approach in Mathematics to Primary students and the results show the improvements in all the six Learning Outcomes (LOs) suggested by NCERT for Mathematics at Primary Level (4th and 5th Grade) viz., solving simple daily life problems using addition and subtraction of three digit numbers, constructing and using the multiplication facts (tables) of 2, 3, 4, 5 and 10 in daily life situations, explaining the meaning of division facts by equal grouping/sharing and finds it by repeated subtraction, creating and solving simple real life situations/ problems including money, length, mass and capacity by using the four operations, identifying half, one-fourth, three-fourths of a whole in a given picture by paper folding and also in a collection of objects, and exploring the area and perimeter of simple geometrical shapes (triangle, rectangle, square) in terms of given shape as a unit.



	Solves simple daily life problems using addition and subtraction of three digit numbers	Constructs and uses the multiplication facts (tables) of 2, 3, 4, 5 and 10 in daily life situati…	Explains the meaning of division facts by equal grouping /sharing and finds it by repeat…	Creates and solves simple real life situations/ problems including money…	Identifies half, one-fourth, three-fourths of a whole in a given picture by…	Explores the area and perimeter of simple geometrical shapes (triangle, rectan…
■Before	14.30%	11.40%	22.90%	14.30%	14.30%	22.90%
■After	45.70%	48.60%	40%	34.30%	40%	54.30%

Difference in Students' Performance before and after Implementation of Bridging Curriculum Approach

The study concludes that the Bridging Curriculum Approach (a blend of Thematic Approach, Interrelated Concepts' Clusters, Multi Utility Activities, and Multi Utility Teaching Learning Materials) in Mathematics, designed and implemented by SCERT Uttarakhand in all the Government Schools of Uttarakhand has positive results in students' learning outcomes. On completion of the session in March 2023, a clear and better picture will evolve when the students' performance will be evaluated via summative assessment in purview of Learning Outcomes set by NCERT New Delhi.

References

Donnelly, R., & Patrinos, H. A. (2021). Learning loss during COVID-19: An early systematic review. Prospects, 1-9.

Kunwar, R. (2020). Math mania: meaning, problems and ways of effective teaching and learning mathematics at basic level education in Nepal. International Journal of Science and Research, 9(8), 1136-1141.

Mannone, M. (2019, June). Have Fun with Math and Music!. In International Conference on Mathematics and Computation in Music (pp. 379-382). Springer, Cham.

NCERT (2017). Learning Outcomes at Elementary Stage, 1-128.

Pai, T. V. (2021). From schooling to learning: For India to make this shift, it must reform the Right to Education Act.

Sajeevan, D., Ravindranath, S., & Krishna, R. (2022). Back at school, Indian teachers face a crisis of discipline, attendance and learning loss. LSE COVID-19 Blog.

SCERT Uttarakhand (2022). Vidyasetu Curriculum for Learning Recovery, 1-57.

Singh, A., Romero, M., & Muralidharan, K. (2022). Covid-19 Learning Loss and Recovery: Panel Data Evidence from India (No. w30552). National Bureau of Economic Research.

Singh, C. B. (2022). School Closures: Facing Challenges of Learning Loss in India. Issues and Ideas in Education, 10(1), 13-19.

Vogt, F., Hauser, B., Stebler, R., Rechsteiner, K., & Urech, C. (2018). Learning through play-pedagogy and learning outcomes in early childhood mathematics. European Early Childhood Education Research Journal, 26(4), 589-603.

APPENDIX-I

501	502	503	504	505	506	507	508	509	510
511	512	513	514	515	516	517	518	519	520
521	522	523	524	525	526	527	528	529	530
531	532	533	534	535	536	537	538	539	540
541	542	543	544	545	546	547	548	549	550
551	552	553	554	555	556	557	558	559	560
561	562	563	564	565	566	567	568	569	570
571	572	573	574	575	576	577	578	579	580
581	582	583	584	585	586	587	588	589	590
591	592	593	594	595	596	597	598	599	600

शिक्षक बच्चों को इस खेल के माध्यम से 501 से 600 तक की संख्याओं को पहचानने एवं पढने का अभ्यास करवायेंगें. इसके बाद शिक्षक चार वर्गाकार आकार की बराबर – बराबर पर्चियां बनायेंगे एवं उनमें 1 से 4 तक के अंक लिखेंगे (यह खेल अधिकतम चार बच्चों के साथ ही खेला जाएगा).

- शिक्षक चारों पर्चियों को एक बार में जमीन पर डालेंगे एवं प्रत्येक बच्चे को कोई एक पर्ची उठाने को कहेंगे. जिस बच्चे के पास 1 संख्या वाली पर्ची आएगी, वह 501 संख्या पर अपनी पहचान वाली कोई वस्तु रखेगा.
- अन्य तीन बच्चे जब तक एक अंक वाली पर्ची नहीं उठा लेते, अपना खेल शुरू नहीं कर सकते. जबकि जिस बच्चे ने अपनी वस्तु 501 संख्या पर रख ली हो – वह हर बार पर्ची डालने के साथ ही उतने कदम **आगे/पीछे** बढेगा या निर्धारित रंग कोड के साथ **आगे/पीछे** बढेगा.
- सर्वप्रथम 600 संख्या तक पहुँचने वाला बच्चा इस खेल को जीत जाएगा.

	5 अंक पीछे		**5 अंक आगे**		**3 अंक आगे**		**10 अंक आगे**		**3 अंक पीछे**

APPENDIX-II

6 बजे शाम को देहरादून से हल्द्वानी जाने वाली बस में 60 सवारी बैठे है, इनमें से $\frac{1}{2}$ सवारी हरिद्वार में 7:30 बजे उतर गयी, जबकि 15 सवारी हरिद्वार से काशीपुर के लिए चढ़ गयी, काशीपुर से 11:30 बजे रात्रि में चलने पर बस रामनगर पहुँची तो $\frac{3}{5}$ सवारियाँ उतर गयी, सवारियों को उतारकर बस हल्द्वानी के लिए आगे बढ़ गयी जहाँ बस 1:00 बजे सुबह पहुँची।

उपरोक्त जानकारी के आधार पर निम्न के उत्तर दीजिये –

1. हरिद्वार में कुल कितनी सवारियाँ उतरी ?
2. देहरादून से काशीपुर पहुँचने पर बस में कुल कितनी सवारियाँ रही होंगी ?
3. रामनगर पहुँचने पर बस से कितनी सवारियाँ उतरी होंगी,
4. शिवांश को देहरादून से रामनगर 6 बजे वाली बस में जाना है, उसके घर से बस स्टेशन तक पहुँचने में 35 मिनट लगते हैं तो शिवांश को घर से कितना पहले बस पकड़ने के लिए निकलना पड़ेगा ?

   (a) . 5:30 बजे **(b)** 5:20 बजे**(c)** 5:35 बजे **(d)** 5:40 बजे

APPENDIX-III

TEAM - A				TEAM - B			
132	154	231	108	102	169	132	231
176	119	142	161	185	154	176	177
169	102	140	185	108	222	153	119
153	222	271	177	140	271	142	161
POINTS – 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10				POINTS – 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10			

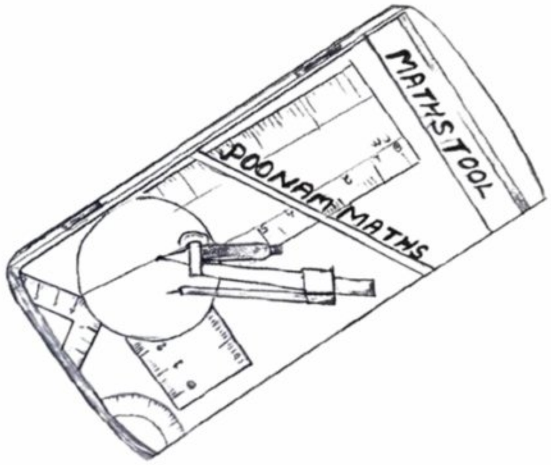
शिक्षक, बच्चों को इस खेल के माध्यम से तीन अंकों की संख्याओं को पहचानने का अभ्यास करवायेंगें.

- सर्वप्रथम सभी बच्चों को दो टीमों में बाँट देंगें एवं बोर्ड पर दोनों ओर 16-16 एक ही संख्याएं (अलग-अलग क्रम में) लिख देंगे.
- उसके बाद प्रत्येक टीम से एक-एक बच्चे बोर्ड पर लिखी संख्याओं के सामने खड़े होंगें.
- शिक्षक बोर्ड पर पहले से लिखी संख्याओं में से किसी एक संख्या को पुकारेंगें.
- दोनों बच्चों में से जो बच्चा सबसे पहले संख्या को पहचानकर उस संख्या पर गोला लगा लेगा, उस टीम को एक अंक प्राप्त हो जाएगा.
- यही प्रक्रिया 10 बार अलग-अलग बच्चों के साथ दोहराई जाएगी.
- सर्वाधिक अंक प्राप्त करने वाली टीम जीत जाएगी.

APPENDIX-IV

अंशिका ने स्टेशनरी की दुकान से एक ज्योमेट्री बॉक्स खरीदा. अगले दिन अंशिका विद्यालय में पहुँची एवं अपने दोस्तों को अपना ज्यामितीय बॉक्स दिखाया, राहुल ने अंशिका से पूछा - क्या तुम्हें पता है कि इस बॉक्स के अन्दर क्या है, तो अंशिका ने जवाब दिया कि इसके अन्दर प्रकार, स्केल, दो त्रिभुज व पेंसिल, रबड़ एवं एक चाँदा होता है।

उपर्युक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिये –



1. अंशिका ने ज्यामितीय बॉक्स को राहुल को दिखाते हुये पूछा कि यह बॉक्स किस आकृति का है ?
2. इस आकृति के कितने तल हैं ?
3. ऊपर से देखने पर ज्यामिति बॉक्स के कितने तल दिखायी देंगे –
   (a) 3 (b) 4
   (c) 1 (d) 2
4. ज्यामिति बॉक्स के अन्दर रखी गयी किन–किन वस्तु की आकृति आयताकार नहीं होती।
5. ऊपर से देखने पर यह आकृति कैसी दिखायी देगी, उसका चित्र बनाइये ?

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A Study of Teaching Competencies of B.Ed. Students of Self-financed and Government Aided Teacher Education Institutions

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ABSTRACT

Teaching process is determined by knowledge, a set of abilities, attitudes and skills (Presage variables), which is turn determine pupil outcomes. Thus, the terms 'teaching' can be defined as a set of observable teacher behaviour that facilitate or bring about pupil learning and 'teaching competency' means an effective performance of all the observable teachers' behaviours that bring about desired pupil out comes. Based on the micro-criteria approach to study 'teaching', teaching is perceived as a set of teaching behaviours that facilitate or bring about a specific instructional objective. In order words, Teaching Competency involves effective use of various teaching skills. Objective of the study is to compare teaching competencies of the B.Ed. students of self-financed and Govt. aided teacher education Institutions. For the present study the investigator had selected 600 students (300 aided colleges and 300 self-finance colleges) have been selected from the population. The research selected The General Teaching Competency Scale (GTCS) constructed by B.K. Passi and Mrs. M.S. Lalitha was used to collect the data. Researcher concluded that B.Ed. students of Self-financed Institutions some were superior and some were similar to Govt. aided colleges in Teaching Competency.

Key words: Teaching competencies, B.Ed. students

Introduction

There were the times when it was believed that teacher are inborn and nothing can be done to improve the teaching abilities of a persons. But the technology of teaching as altered this belief and has presented a clear cut possibility of further development in the teaching abilities of any person of any teaching ability level considering the possibilities of further development in the teaching training institutions were established, who are producing a large number of trained teacher. But inspite of all these attempts, the teacher training institutions could not meet to desired end of producing affective teachers. (Buch 1975, Sharma & Malhotra 1979, Sansanwal & Jorial 1980) Similarly the report of the Education commission, 1966 says "the quality of training institutions reminds, with a few exceptions, either mediocre or poor competent

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staff are not attracted, vitality and realism are lacking in the curriculum and programmers of work which continue to be largely traditional and set pattern and rigid technique are followed in practice, with a disregard for present day needs and objectives".

However, regarding the concept definition and scope of teaching competency, there has been a little agreement amongst concerned researchers. The reason for this agreement appears to tem from two reasons. First, 'confusion' has resulted due to interchangeable use ability of a large variety of terms. For example, teacher competence teacher effectiveness, teachers efficiency teaching success characteristics of a teacher. Criteria of competence ability to teach and host of other terms have been used to mean the some concept. Secondly there is a disagreement as of which criteria of Teaching Competency are essential ones. For example should the teacher be expected to produce immediate effects or long range consequences?

Should they exhibit similar components in all situations in respect of different kinds of schools pupil, subjects, and grades and so on? The problem becomes more complex because of the verities of outcome that may result from teaching.

The concept of Teaching Competency emerged from competency based teacher Education (CBTE) Programmed. It has been seemed that there is no agreement among the educationists regarding the concept of "competency" this disagreement is due to the confusion between the concepts of Teaching Competency and teacher competency. Teaching Competency is said to be the knowledge, attitude, skills and self perception or the products that derive from the mix of these behavior resulting in consistent pattern of behavior leading to the attainment of predicted outcomes (Wilson 1973)

On the other hand, teacher competency has been defined as the average success of all teachers' behaviors in achieving his intended effect (Medley and Mitzel 1963). Teacher competency is a wide term including teacher's personality, presage, process and product variables while Teaching Competency is retraced to the teaching behaviors presented during class-room teaching.

Teaching Competence:

The concept of Teaching Competency includes accountability and responsibility as a teacher. It also included the, Efficiency, Mastery over the subject matter, Communication skills, Ability to develop sound and good inter-personal relationship with the students, and Skills of evaluating the learning experience and expected learning outcomes.

Teaching process is determined by knowledge, a set of abilities, attitudes and skills (Presage variables), which is turn determine pupil outcomes. Thus, the terms 'teaching' can be defined as a set of observable teacher behaviour that facilitate or bring about pupil learning and 'teaching competency' means an effective performance of all the observable teachers' behaviours that bring about desired pupil out comes. Based on the micro-criteria approach to study 'teaching', teaching is perceived as a set of teaching behaviours that facilitate or bring about a specific instructional objective. In order words, Teaching Competency involves effective use of various teaching skills.

The definition of teaching competence

given by B.K. Passi & M.S. Lalitha has been adopted for this research.

Teaching competence mean the effective performance of all the observable teacher behavior that bring about desired pupil out comes. They are related to five major aspects of teaching namely, planning, presentation, closing, evaluation and managerial.

Statement of the Problem

The statement of the problem has been stated as -"A Study of Teaching Competencies of B.Ed. Students of Self-financed and Government Aided Teacher Education Institutions."

Objectives of the Study

Present study will be attempts to achieve following objective:

1. To compare teaching competencies of the B.Ed. students of self-financed and Govt. aided teacher education Institutions.

This objective divided into 16 sub-objectives of 16 dimensions.

Hypotheses Study

To achieve the objectives of the study following hypothesis will be formulated and tested:

1. B.Ed. students studying in self-financed and govt. aided teacher education institutions do not differ significantly on their teaching competencies.

This hypothesis is divided into 16 sub-hypotheses of 16 dimensions.

Delimitations of the study

The study has delimitated to:

1. Teacher Education Institutions affiliated to Ch. Charan Singh University, Meerut
2. Teaching competencies of the B.Ed. students of secondary teacher education institution.
3. Present study will be delimited to Teaching Competency variables only.

Method of the study

To conduct the present research The survey method of research has been used.

Population of The Study

All the teacher educators and B.Ed. students of Govt. aided and Self-financed teacher Education Institutions affiliated to Ch. Charan Singh University, Meerut constituted population of the study.

Sample of the Study

The total number of B.Ed. students who are studied for the development of their competencies in teaching was in govt. aided colleges was 300. On the contrary from self-financed institutions 20 students were again selected from each institution (15 self-financed institutions) through lottery method. Thus, the total number of B.Ed. students came out is 300. Therefore, the final sample of B.Ed. students consisted of 600 inclusive of govt. aided and self-financed institutions.

Statistical Techniques Used

Descriptive as well as inferential statistical Techniques like, Mean, SD, 'T' Value etc. were used in present study.

Tools Used

The General Teaching Competency Scale (GTCS) constructed by B.K. Passi and Mrs. M.S. Lalitha were used to collect the data.

Analyses and Interpretation of the Data

Table-1: Comparison of Teaching Competency (Lesson Planning) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	14.833	1.901	0.022	Not Significant
2.	B.Ed. students Self-financed Institutions	300	14.837	1.752		

Interpretation: Comparison of Teaching Competency (lesson Planning) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 1 test of significance shows not significant 't' value 0.022 for df of 598. It is obvious from 't' value shown in table 1 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of lesson planning.

Equal competency in lesson Planning of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score, is up to 2 digit of decimal, shows neck to neck effort made by two group of B.Ed. students.

Table-2: Comparison of Teaching Competency (Introduction) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.683	0.506	1.477	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.613	0.646		

Interpretation: Comparison of Teaching Competency (lesson Planning) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 1 test of significance shows not significant 't' value 0.022 for df of 598. It is obvious from 't' value shown in table 1 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of lesson planning.

Equal competency in lesson Planning of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score, is up to 2 digit of decimal, shows neck to neck effort made by two group of B.Ed. students.

Table-3: Comparison of Teaching Competency (Questioning) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.677	0.495	0.000	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.677	0.553		

Interpretation: Comparison of Teaching Competency (Questioning) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 3 test of significance shows not significant 't' value 0.000 for df of 598. It is obvious from 't' value shown in table 4.3 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of questioning.

Equal competency in questioning of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score, is up to three digit of decimal, shows neck to neck effort made by two group of B.Ed. students

Table-4: Comparison of Teaching Competency (Probing Question) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.653	0.516	0.560	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.627	0.643		

Interpretation: Comparison of Teaching Competency (Probing Question) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 4 test of significance shows not significant 't' value 0.560 for df of 598. It is obvious from 't' value shown in table 4.4 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of Probing Question.

Equal competency in Probing Question of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score, is up to one digit of decimal, shows neck to neck effort made by two group of B.Ed. students.

Table-5: Comparison of Teaching Competency (Explanation) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institution

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.413	0.512	0.071	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.417	0.635		

Interpretation: Comparison of Teaching Competency (Explanation) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 4.5 test of significance shows not significant 't' value 0.071 for df of 598. It is obvious from 't' value shown in table 5 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of Explanation.

Equal competency in Explanation of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score, is up to two digit of decimal, shows neck to neck effort made by two group of B.Ed. students.

Table-6: Comparison of Teaching Competency (Illustration) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutionss

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.630	0.503	0.000	Not Significant
2.	B.Ed. students Self-financed Institutions	300	0.630	0.594		

Interpretation: Comparison of Teaching Competency (Illustration) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 6 test of significance shows not significant 't' value 0.000 for df of 598. It is obvious from 't' value shown in table 4.6 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of Illustration.

Equal competency in Illustration of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score, is up to three digit of decimal, shows neck to neck effort made by two group of B.Ed. students.

Table-7: Comparison of Teaching Competency (Stimulus Variation) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.640	0.507	0.073	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.637	0.604		

Interpretation: Comparison of Teaching Competency (Stimulus Variation) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 4.7 test of significance shows not significant 't' value 0.073 for df of 598. It is obvious from 't' value shown in table 7 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of Stimulus variation.

Equal competency in Stimulus variation of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score, is up to two digit of decimal, shows neck to neck effort made by two group of B.Ed. students

Table-8: Comparison of Teaching Competency (Reinforcement) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	2.917	0.393	3.314	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.050	0.511		

Interpretation: Table 8 shows the analysis of data regarding comparison of Teaching Competency namely, Reinforcement skills of B.Ed. students belonging to Govt. aided and self financed teacher training institutions. The obtained 't' value 3.314 is significant at .01 level of confidence. The significance of 't' value leads to the rejection of null hypotheses which further explains that two groups of B.Ed. students teaching in Govt. aided Colleges and self financed Institutions differ significantly in their Teaching Competency Reinforcement skills.

Since mean competency score of B.Ed. students belonging to self financed institutions is higher than the mean competency score of B.Ed. students of Govt. aided institutions. Therefore; it can be concluded that on the whole, B.Ed. students of self financed institution are found to be more competent in the use of Reinforcement teaching skills.

Table-9: Comparison of Teaching Competency (Students Participation) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institution

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	2.837	0.465	6.169	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.077	0.487		

Interpretation: Table 9 shows the analysis of data regarding comparison of Teaching Competency namely, Students Participation skills of B.Ed. students belonging to Govt. aided and self financed teacher training institutions. The obtained 't' value 6.169 is significant at .01 level of confidence. The significance of 't' value leads to the rejection of null hypotheses which further explains that two groups of B.Ed. students teaching in Govt. aided Colleges and self financed Institutions differ significantly in their Teaching Competency Students Participation skills.

Since mean competency score of B.Ed. students belonging to self financed institutions is higher than the mean competency score of B.Ed. students of Govt. aided institutions. It may therefore be concluded that the B.Ed. students of self financed institution are superior to Govt. aided institutions with regard to their Teaching Competency i.e., students Participation skills

Table-10: Comparison of Teaching Competency (Pacing Lesson) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.603	0.509	1.758	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.680	0.558		

Interpretation: In table 10 Statistically treated data related to comparison of Teaching Competency in terms of teaching skill (Pacing Lesson) of student teacher of Govt. aided and self financed teacher training institutions has been presented as 't' score. Statistically obtained 't' value 1.758 is lesser than minimum significant 't' value 1.96 at .05 level of confidence for df 598. Thus obtained 't' value is not significant. It shows that B.Ed. students of Govt. aided and self financed teacher training institutions do not differ significantly in terms of their teaching competency, more precisely pacing lesson skills. Operant difference in mean competency score after two groups is not real it is due to chance are major error.

Table-11: Comparison of Teaching Competency (Interaction) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.633	0.509	1.746	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.710	0.565		

Interpretation: In table 11 Statistically treated data related to comparison of Teaching Competency in terms of teaching skill (Interaction) of student teacher of Govt. aided and self financed teacher training institutions has been presented as 't' score. Statistically obtained 't' value 1.746 is lesser than minimum significant 't' value 1.96 at .05 level of confidence for df 598. Thus obtained 't' value is not significant. It shows that B.Ed. students of Govt. aided and self financed teacher training institutions do not differ significantly in terms of their teaching competency, more precisely interaction skills. Operant difference in mean competency score after two groups is not real it is due to chance are major error.

Table-12: Comparison of Teaching Competency (Black-Board Writing) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.890	0.558	1.688	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.970	0.602		

Interpretation: In table 4.12 Statistically treated data related to comparison of Teaching Competency in terms of teaching skill (Black-Board Writing) of student teacher of Govt. aided and self financed teacher training institutions has been presented as 't' score. Statistically obtained 't' value 1.688 is lesser than minimum significant 't' value 1.96 at .05 level of confidence for df 598. Thus obtained 't' value is not significant. It shows that B.Ed. students of Govt. aided and self financed teacher training institutions do not differ significantly in terms of their teaching competency, more precisely Black-Board Writing skills. Operant difference in mean competency score after two groups is not real it is due to chance are major error.

Table-13: Comparison of Teaching Competency (Closer) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.693	0.516	3.247	Not Significant
2.	B.Ed. students Self-financed Institutions	300	3.847	0.635		

Interpretation: Table 13 displaced statistically treated data regarding Teaching Competency closer skills of B.Ed. students of Govt. aided and self financed Teacher Education institutions. Obtained 't' value 3.247 is significant at .01 level of confidence. It shows rejection of null hypotheses, which reads B.Ed. students of Govt. aided and self financed teacher education colleges differ significantly on their Teaching Competency particularly closer skills of teaching. Mean competency score of B.Ed. students are self financed institutions is higher than mean competency score of their counter Part of B.Ed. students studying in Govt. aided teacher education institutions. On the basis of result shown in the table it can be concluded safely that B.Ed. students of self financed institutions are superior to B.Ed. students of Govt. aided institution in Teaching Competency particularly closer skills.

Table-14: Comparison of Teaching Competency (Home Assignment) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.220	0.515	8.766	Significant at 0.01
2.	B.Ed. students Self-financed Institutions	300	3.640	0.651		

Interpretation: Table 14 displaced statistically treated data regarding Teaching Competency Home Assignment skills of B.Ed. students of Govt. aided and self financed Teacher Education institutions. Obtained 't' value 8.766 is significant at .01 level of confidence. It shows rejection of null hypotheses, which reads B.Ed. students of

Govt. aided and self financed teacher education colleges differ significantly on their Teaching Competency particularly Home Assignment skills of teaching.

Mean competency score of B.Ed. students are self financed institutions is higher than mean competency score of their counter Part of B.Ed. students studying in Govt. aided teacher education institutions. On the basis of result shown in the table it can be concluded safely that B.Ed. students of self financed institutions are superior to B.Ed. students of Govt. aided institution in Teaching Competency particularly Home Assignment skills.

Table-15: Comparison of Teaching Competency (Evaluating) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	3.220	0.515	8.766	Significant at 0.01
2.	B.Ed. students Self-financed Institutions	300	3.640	0.651		

Interpretation: Comparison of Teaching Competency (Evaluating) of B.Ed. students belonging to Govt. aided and self financed teacher education institutions has been displayed in terms of 't' value in table No. 15 test of significance shows not - significant 't' value 0.039 for df of 598. It is obvious from 't' value explains in table 415 that B.Ed. students of self financed institutions are as competent as B.Ed. students are Govt. aided institutions in their skills of Stimulus Variation.

Equal competency in Stimulus Variation of the B.Ed. students of Govt. aided and self financed institution have also been Proved by their mean competency score equality in score is up to One digit of decimal, shows neck to neck effort made by two group of B.Ed. students.

Table-16: Comparison of Teaching Competency (Home Assignment) of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	7.123	0.689	4.124	Significant at .01
2.	B.Ed. students Self-financed Institutions	300	7.407	0.970		

Interpretation: Table 16 displaced statistically treated data regarding Teaching Competency classroom management skills of B.Ed. students of Govt. aided and self financed Teacher Education institutions. Obtained 't' value 4.124 is significant at .01 level of confidence. It shows rejection of null hypotheses, which reads B.Ed. students of Govt. aided and self financed teacher education colleges differ significantly on their Teaching Competency particularly classroom management skills of teaching.

Mean competency score of B.Ed. students are self financed institutions is higher than mean competency score of their counter Part of B.Ed. students studying in Govt. aided teacher education institutions. On the basis of result shown in the table it can be concluded safely that B.Ed. students of self financed institutions are superior to B.Ed. students of Govt. aided institution in Teaching Competency particularly classroom management skills.

Table-17: Comparison of Teaching Competency of B.Ed. students of Govt. Aided and Self-financed Teacher Education Institutions

Sl. No.	Name of Group	N	Mean	S.D.	't'	Level of Significance
1.	B.Ed. students Govt. aided Institutions	300	74.697	7.668	2.264	Significant at .05
2.	B.Ed. students Self-financed Institutions	300	76.053	6.992		

Interpretation: Table 17 shows the analysis of data regarding comparison of teaching competency, as a whole of B.Ed. students belonging to Govt. aided and self-financed teacher training institutions. The obtained 't' value 2.264 is significant at .05 level of confidence. The significance of 't' value leads to the rejection of null hypotheses which further explains that two groups of B.Ed. students teaching in Govt. aided colleges and self-financed institutions differ significantly in their Teaching Competency as a whole.

Since mean competency score of B.Ed. students belonging to self-financed institutions is higher than the mean competency score of B.Ed. students of Govt.-aided institutions. Therefore, it can be concluded that on the whole, B.Ed. students of self-financed institutions are found to be more competent in the use of teaching skills.

Conclusion

On the basis of validation of Hypotheses following conclusion were drawn:

1. In Teaching Competency (Lesson Planning, Introduction, Questioning, Probing Question, Explanation, Illustration, Stimulus Variation, Pacing Lesson, Interaction, Black Board Writing, Evaluating) of B.Ed. students of Self-financed Institutions were similar to Govt. aided colleges.
2. In Teaching Competency (Reinforcement, Students Participation, Closer, Home Assignment, Class Room Management) of B.Ed. students of Self-financed Institutions were superior to Govt. aided colleges.

References

Asija, Ranveer Pratap (1990) Teaching Competence as related to development of skills specific to teaching of biology through microteaching among prospective secondary school teachers. Ph.D. Edu. Panjab University, Punjab.

Behera, S.C. (1990) An investigation into the impact of educational television programmes on the competency of teachers of elementary schools. Ph.D., Education, Utkal University.

Buch, M.B. (Ed.) (1979) Second Survey of Research in Education (1972-78), Society for Educational Research and Development, Baroda.

Chaudhary, Kamlesh (1989) Teaching of concepts through concept attainment model and facts through traditional teaching: competency in teaching skills of perspective teachers. Independent Study, Pune: Adarsha Comprehensive, College of Education and Research.

Evrim Barana, Ana-Paula Correiab and Ann Thompson (2011) Transforming online teaching practice: critical analysis of the literature on the roles and competencies of online teachers, Distance Education, Vol. 32, No.2, pp. 421.439.

Naree Aware Achwarin, R.N. (2009) The Study of Teacher Competence of Teachers at Schools in the Three Southern Provinces of Thailand, retrieved from www.journal.au.edu/ scholar/ 2009/word/nareeAwareAchwarin156.doc

National research Council (2001), Testing teacher candidates: The role of licensure test in improving teacher quality. Washington, DC: National Academy Press.

Passi, B.K. and Sharma, S.K. (1981) A Study of teaching competencies among Secondary Teachers". Department of Education, University of Indore.

Singh, L.C. (1989) "Relative effectiveness of two training strategies in developing teaching competence and attitude towards teaching among student teachers. Independent Study, National Council of Educational Research and Training (UNESCO Funded).

Sunita Badola (2012) A Study of Job Involvement, Job Satisfaction and Teaching Competency of Secondary and Senior Secondary Teachers, Journal of Education & Pedagogy, Vol. IV, No. 2, pp. 49.54.

Verma, Bhagwan Swaroop (1988). "Developing Teaching Competency among student teachers of science group through microteaching: An experiment, Ph.D. Edu., Agra University, Agra.

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