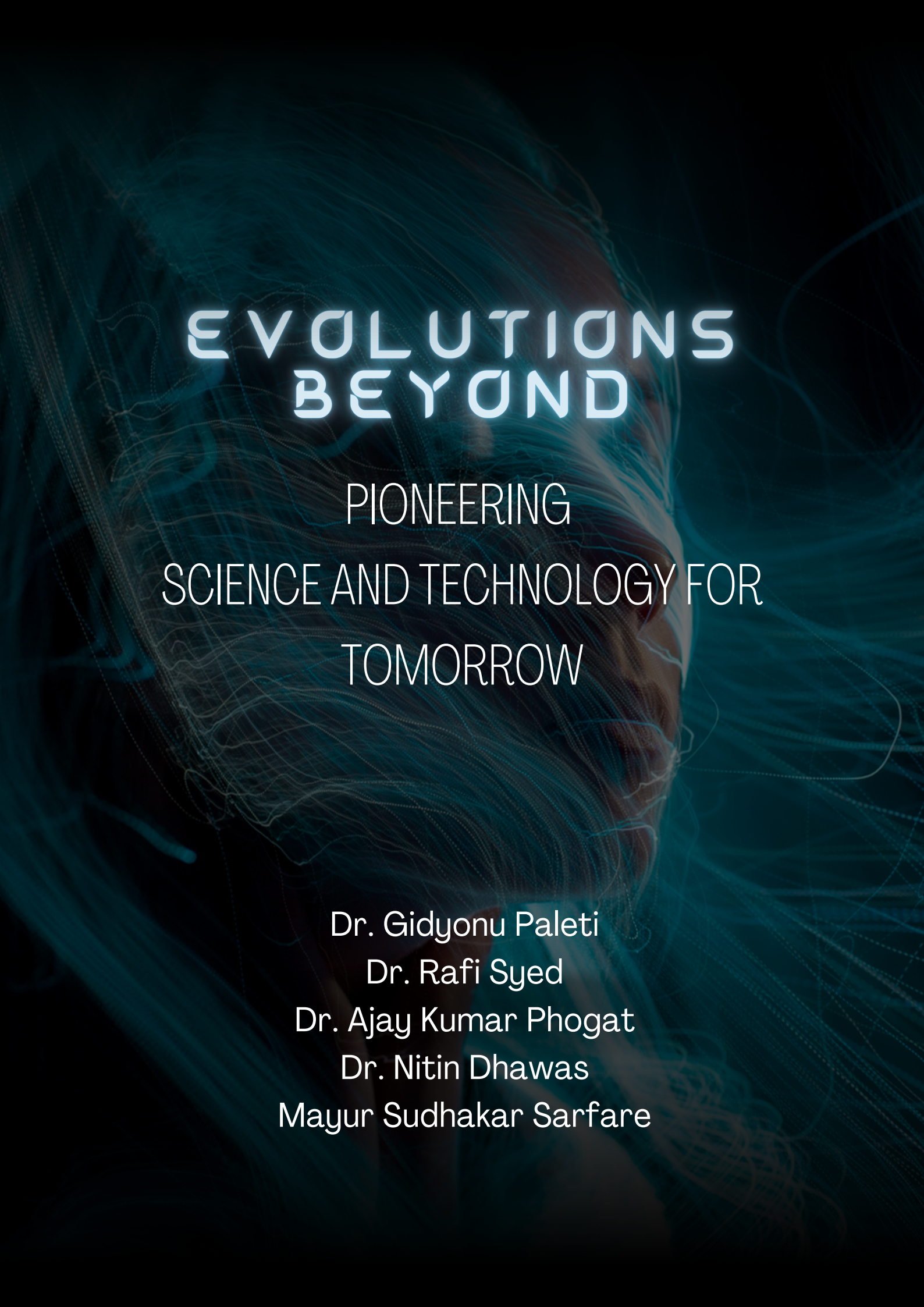

EVOLUTIONS BEYOND

PIONEERING SCIENCE AND TECHNOLOGY FOR TOMORROW

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Evolutions Beyond:

Pioneering Science and Technology for Tomorrow

India | UAE | Nigeria | Uzbekistan | Montenegro | Iraq | Egypt | Thailand | Uganda | Philippines | Indonesia

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Preface

The book "**Evolutions Beyond: Pioneering Science and Technology for Tomorrow**" probes into the human's quest for advancement. This book focuses on scientific exploration and technological innovation, where the boundaries constantly pushing the boundaries.

Today, we are standing at the nexus of groundbreaking discoveries and revolutionary inventions that have the power to reshape our lives, societies, and the entire trajectory of our species. "Evolutions Beyond" seeks to bridge the gap between the incredible possibilities that lie ahead and the collective imagination that fuels our ambitions. It explores not only unravels new research but also the ethical and philosophical dimensions that accompany these innovations, challenging us to consider the implications of our progress.

As we immerse ourselves in the pages of "Evolutions Beyond," we invite you to envision a world where boundaries are transcended, limitations are shattered, and the unknown is embraced with fervour.

Acknowledgement

This edited book on "**Evolutions Beyond: Pioneering Science and Technology for Tomorrow**" is an attempt to gather recent research and present them to readers who can gain insights into the new world science and technology research solving complicated research problems. We would like to extend our deep gratitude to various researchers who work hard to perform the task and present their findings in the form of research articles.

We would like to express our gratitude from the core bottom of our hearts to **IARA Publication** for their strong support during the entire publication process. We are thankful to the Almighty that our book came into existence.

We are also grateful to our immediate family members for being supportive throughout the Publication process and also for bearing with us as we were not able to give them enough time during this entire process of Publication.

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DEVELOPMENT OF ANDROID-BASED LEARNING MEDIA WITH KODULAR ASSISTANCE IN NEWTON'S LAW MATERIALS

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INTRODUCTION

The development of science and technology encourages teachers to produce computer-based learning media. With technological advances, it is easier for teachers to make learning media for subjects that require high costs (Muyaroah & Fajartia, 2017). Arsyad explained that "the application of media inside the studying system can generate new desires and pastimes, growth motivation and stimulus for studying, and actually have a mental impact on college students (Arsyad, 2017). The combination of the application of a real-virtual laboratory assisted by Phet software is very effective in developing student HOTS and Soft Skills (Rahem & Suprianto, 2018). one of the ICT-assisted studying media that may be used is inside the form of studying media that runs on smartphone gadgets with the Android operating system. currently, the Android working device is the most famous working system and is widely used by most of the people, in particular high college students. Using Android-based studying media is one of the 21st-century getting to know fashion applications (Yektyastuti & Ikhsan, 2016). Android smartphones are used as communication media by students as one of the potentials that are able to develop and support virtual learning in high school (Adesti & Nurkholimah, 2020). However, there are still many people in Indonesia who have not been able to use it properly. In the field of education, for example, many students often misuse smartphones during the teaching and learning process.

Most smartphone users, especially Android users, only use existing facilities for social media as a means of entertainment, and it is not uncommon to access negative content. The tendency of people to spend time using their smartphones is a real

phenomenon that is making Android smartphones increasingly popular (Ningsih & Adesti, 2019). The advantage of Android-based learning media is that it can be accessed or used anytime, anywhere. This is in accordance with the results of research (Fatimah & Mufti, 2014; Ningsih & Adesti, 2019) which states that mobile learning is an interesting learning where users can access wherever and whenever as needed so as to increase student understanding because it can be accessed redundantly, besides being able to increase student learning motivation.

Teachers should take advantage of technological developments properly because teachers are required to be more creative in using the media used for learning. This opinion is in line with the results of research which explains that the development of educational games based on macromedia flash fosters students' interest in learning physics (Ida Kholida, Suprianto, & Ketut Mahardika, 2020). The application of animation media in physics learning is very effective in increasing students' understanding and interest in learning physics (Suprianto & Kholida, 2020). Animated media in smartphones is also suitable for studying immune system material for high school students (Sari, Widyanto, & Kamal, 2018). However, not a few teachers are less imaginative in creating and changing learning media, even though teachers are required to have the option to grow the ability to create inventive and creative learning media so that students have interest and energy in concentrating on science material.

The learning system combines exercises such as mentioning objective facts, such as performances and others not only by getting material from the instructor. Learning with these exercises can improve the ability of every student who is involved in supporting Information and Communication Technology. Learning media such as computers, laptops, smartphones, and other electronic media make it easy for students to learn (Muqarrobin & Kuswanto, 2016). One of the media that utilizes innovation in media based on Android applications. There has been a change in the way to access information and communication which is getting faster and easier with the smartphone (Rotondi, Stanca, & Tomasuolo, 2017).

Based on the results of interviews with some physics teachers in several high schools in Pamekasan, during the Covid19 pandemic they often used Android as a learning medium. Applications that are often used by high school teachers in Pamekasan are Zoom Meeting and Whatsapp messenger. The use of zoom meeting and whatsapp messenger applications in the Project Based Learning model can improve learning outcomes, and student activity and creativity (Kholida & Suprianto, 2020). Online learning using this zoom meeting can be face to face just like conventional classes. Ease of use Features in Zoom meetings make learning more interesting, but learning will be interrupted if it is not a premium zoom (Irmada & Yatri, 2021). The Zoom application has advantages, namely (1) there is a virtual face-to-face process between lecturers and students such as lectures in the classroom, and (2) the availability of optional features with good video conferencing quality. unstable in some areas, (2) lack of smartphones or androids owned by students, (3) limited internet quota, and (4) high costs. (Wena, 2020). Weaknesses in using WhatsApp Messenger, namely 1) the learning materials delivered will be piled up by messages from group members or messages from other people outside the class group. 2) The limitations of the WhatsApp application in structuring student assignment documents are not clear because the teacher gives directions via text messages. 3) The potential of students also cannot be explored more broadly because the implementation of learning carried out by the teacher is only limited to greeting students via text messages, sending learning videos, giving assignments and students completing assignments and taking photos and sending them back to the teacher (Hidayati, Syaikhu, & Nugraheny, 2021). This makes it difficult for students to better understand the lesson, thus making the learning process ineffective. From these problems, it is important to take advantage of innovations in the field of teaching by developing Android-based learning media, in addition to increasingly extraordinary mechanical improvements, Android is the most widely used work system among the many choices of work systems for smartphones. Android is a Linux-based framework that is (open source) and is intended for contact screen phones, such as mobile phones and tablet PCs (Salbino, 2014). There are 4

application components that are an important part of Android, namely: Activity, Service, Broadcast receiver, Content Provider (Leuw, Andjarwirawan, & Wibowo, 2013). One of the android-based learning media that can be used is kodular-assisted learning media.

Kodular is a website that provides tools for creating Android applications using block programming. In designing this electronic teaching material, we use a kodular web to create applications that can be used without using coding and there is no cost in making applications, this makes it easier for those who are experienced and beginners who want to make android applications. From the description above, the author intends to develop an application that uses code to create smartphone-based teaching materials. In Kodular there is a coding system that is carried out through a block puzzle of each component combined with every attribute and method, which is automatically available when the user places a component in the design section. Making puzzle blocks is done on each screen by drag and drop to the block work area, there are several block options ranging from control, logic, blocks for mathematical functions and so on. The use of this block function makes it easy for novice developers who do not understand programming languages to be able to use codular applications.

METHOD

The method used in this research is referred to as the research and development method or generally the so-called research and development method (R&D) in the context of the Borg & Gall development methodology, which is a technical model that describes a procedure or series of operations. conducted. Created for new product production or new product development. It already exists, increasing the efficiency and effectiveness of the system (Sugiyono, 2018). Research and development of the Borg and Gall model modified by Sugiyono requires ten steps to produce a final product that is ready for education. However due to time constraints, the researcher limited the development study from 10 to 7 steps, and the researcher wanted to see if the product could be used in the classroom as an adjunct or addition

to physics, and they saw the answer. We ask students' interest not to spread. The procedure or steps taken by the researcher can be seen in the following diagram:

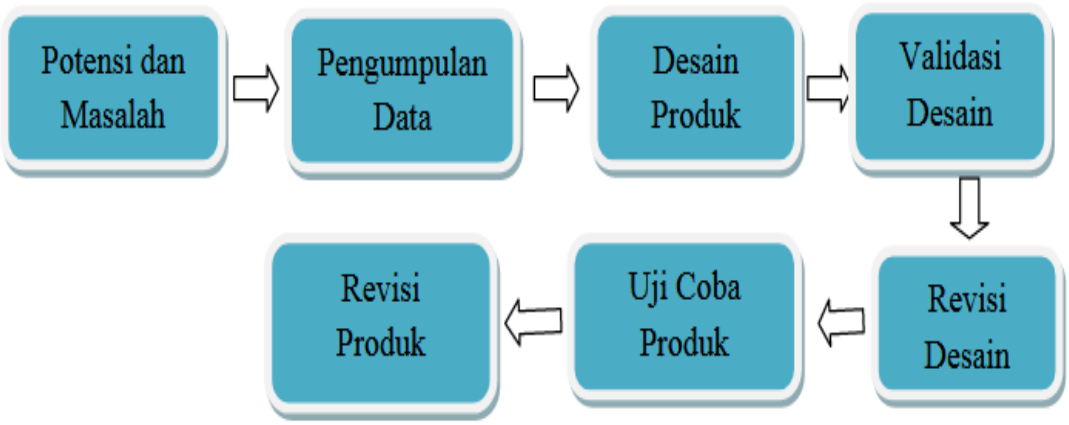


Figure 1: R&D model (Sugiyono, 2018)

In this study, the location of data collection was at SMA Bustanul Mubtadiin. This android-based learning media is validated first by validators from material experts and learning media experts who are competent in their fields. The expert on Android-based learning media materials comes from the physics education study program lecturer at Universitas Islam Madura, while the media expert comes from the information engineering study program lecturer at Universitas Islam Madura. to calculate the Valid score whether or not the learning media is determined from the percentage match of the validation results as follows:

The formula for analyzing the questionnaire data is as follows:

$$\text{Va} = \frac{TSe}{TSh} \times 100\%$$

Information:

Va = Validity of the expert

Tse = Total empirical score (result of expert validation)

TSh = Total maximum expected score (Akbar, 2013)

To determine the validity criteria based on the percentage criteria using a Likert scale with interpretation guidelines used in the following table:

Table 1: Learning Media Validity Criteria

Criteria Interval	Criteria Interval
0 – 20% Very Invalid, or should not be used	0 – 20% Very Invalid, or should not be used
21% -40% Invalid, it is recommended not to use because it needs major revision	21% -40% Invalid, it is recommended not to use because it needs major revision
41% -60% Enough, can be used with standard revision	41% -60% Enough, can be used with standard revision
61% -80% Valid, or can be used but need minor revision	61% -80% Valid, or can be used but need minor revision
81%-100% Very valid, or can be used without revision	81%-100% Very valid, or can be used without revision

FINDING AND DISCUSION

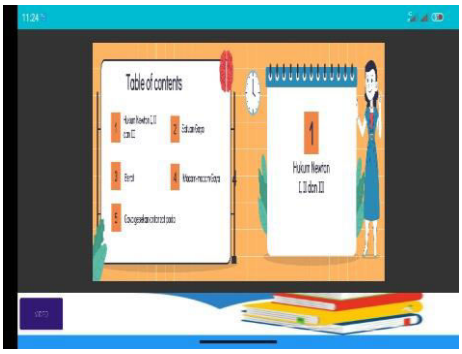
Product Yield

Based on the results of the products that have been carried out from several steps, the results of the products that have been designed are as follows:

a. App View

Picture 2: app view

b. Material Display

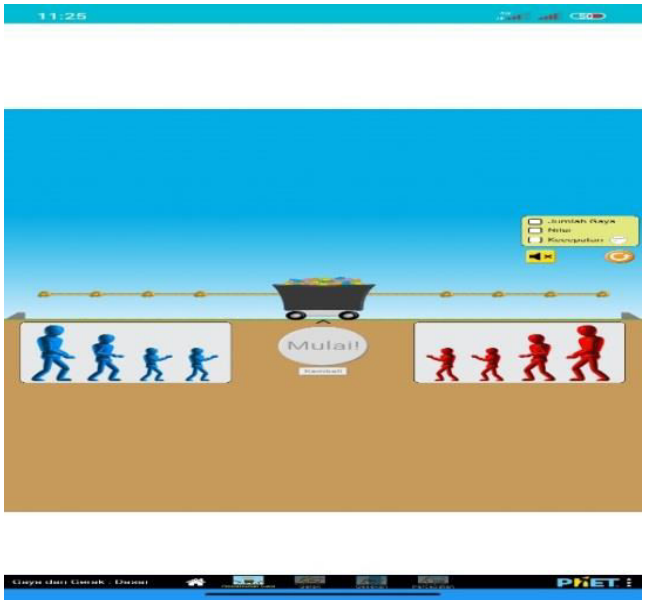


Picture 3: material display

c. Video View

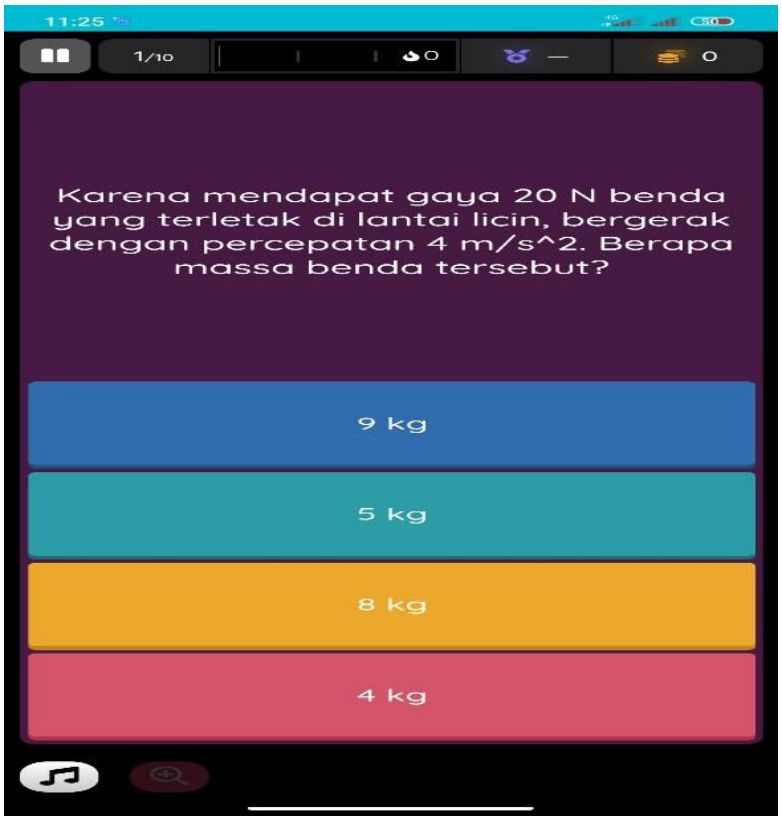
Picture 4: video view

d. Virtual Lab View



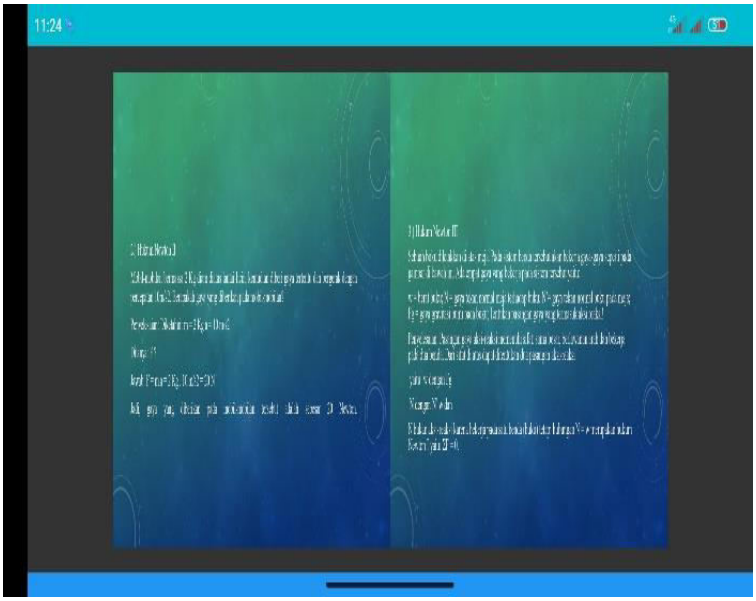
Picture 5: virtual lab view

e. Quiz View



Picture 6: quiz view

f. Sample Question Display



Picture 7: sample question display

Validation Data Result

The data from the media validation results were obtained through filling out an assessment questionnaire which had 20 statements. The total score obtained on media validation is 81%, 86%, and 88%. The ideal value for each statement is 5, so the ideal value for the entire statement is 100. The result of the percentage calculation after the average obtained from media experts is 85%. Based on the criteria for the percentage validity of the media expert score, this value is included in the appropriate criteria, or can be used with slight revisions.

The data from the material validation results were obtained through filling out an assessment questionnaire which had 21 statements. The total score obtained in the validation of the material is 80% and 86%. The ideal value for each statement is 5, so the ideal value for the entire statement is 100. The result of the percentage calculation after the average obtained from material experts is 83%. Based on the criteria for the percentage validity of the material expert score, the score is included in the appropriate criteria, or can be used with a slight revision.

After the media was carried out a feasibility test by material experts and media experts, it was concluded that the media was suitable for use with several revisions. This is in accordance with the results of research (Syarlisjiswan, Sukarmin, & Wahyuningsih, 2021) which produces media in the form of a code-based e-module that is feasible to be tested in learning. This research does not only develop codular-assisted e-modules such as research (Rismayanti, Anriani, & Sukirwan, 2022; Sarita, Sujud, Jati, & Ayundasari, 2021; Syarlisjiswan et al., 2021) but also adds a virtual Laboratory using PheT as well as adding video and Quiz features to facilitate and motivate students in learning physics and improve process skills student science.

Based on these results, this android-based learning media using codular is a suitable media to be used in the learning process because in the media there is an animation that serves to explain the material in a constructivist way, besides that there is a worksheet that is equipped with PheT software which aims to improve students' science process skills. . This is in line with the results of research (Radita &

Nurfauziah, 2022) which explains that the Codular-assisted Android-based Mathematics Mobile Learning media is a feasible and practical medium in helping students understand the Pythagorean concept. The development of android-based media with codular assistance aims to meet the needs of teachers and students when learning online, because this product is equipped with virtual labs and exercises to strengthen student concepts, students can fill out exercises directly on the product and get feedback from the answers given, so students are motivated and eager to do evaluations because of the desire to get a higher rank, and is expected to improve student learning outcomes (Jamal et al., 2022). The application of physics animation videos is very helpful for students in learning temperature material and its changes anywhere and anytime without being limited by space and time, as well as being able to explain abstract physics concepts (Sumarni, Bhakti, Astuti, Sulisworo, & Toifur, 2020).

The advantage of this android-based media is that the student's learning process is not only in class but can learn whenever and wherever according to their needs, besides that students can also repeat material that they do not understand. This is of course different from conventional learning, where students cannot repeat what they do not understand at different times.

CONCLUSION

Based on the research, the researchers created an android-based learning media with codular assistance on Newton's Law material that was packaged in the form of an Android application for cellphones. This learning media is made using a coded WEB which is a site that provides tools for creating Android applications. This learning media contains material that is in the form of a flipbook that will make students interested in continuing to learn, not also in the material there are several other menus, such as videos in the form of 3D animations, virtual labs, and quizzes.

The result of the calculation of the percentage of media experts is 68.5% which is included in the criteria of being eligible/usable with a slight revision. The results of calculations from material experts are 70.6% which are included in the criteria that

are feasible/can be used with a few revisions. This is a codular-assisted android-based learning media on Newton's Law material that shows that it is suitable for use in learning Newton's Law. although this Kodular-assisted Android-based learning media is feasible to use, it has drawbacks so that further development so that the products developed are better and better, it is feasible again by multiplying materials, videos, virtual labs, and quizzes and adding more interesting designs.

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THE EFFECTIVENESS OF WEB-BASED PHYSICS LEARNING MEDIA ASSISTED BY THE WIX PLATFORMS

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INTRODUCTION

The development of science and technology in the Industrial Revolution Era 4.0 progressed very rapidly so that it was able to create new innovations. This progress cannot be separated from the achievement of the goals of the education system, every learning requires strategies, methods and learning media. The use of innovative learning media in supporting the teaching and learning process itself (Astuti& Bhakti, 2018). Students need new learning media so that the learning process is not monotonous, especially in learning physics (Irwandani&Juariah, 2016)

Media as a means of connecting the two parties. Learning media is used to convey learning messages, focus students on concentration in learning activities (Astuti et al., 2017). Learning media greatly influences the conditions and learning environment in the form of how teachers and students establish communication and learning in order to create effective learning (Purnama et al., 2017). The media itself includes graphic media, maps, globes including books, videos, slide shows. In other words, the media includes software (software) and hardware (hardware) as learning aids (Mudlofir&Rusydiyah, 2016).

The use of technology-based media according to the development of knowledge and technology facilitates communication and interaction between educators and students so that teachers must master in carrying out their professional functions so as to create effective learning (Hamid, 2020). This can be done by distance learning.

The distance learning process can be interpreted as learning that is conveyed through the internet or other computer network media in providing teaching materials that can be accessed anytime and anywhere by students. Learning media that can be used

is E-learning. E-learning is user-centered, interactive and as an open, flexible and distributive learning environment so that it can be seen as an innovative approach to be used as a good delivery media design (Wahyudi, 2017). Learning media that can be used to accelerate student learning with better results is e-learning (Kristiyani&Budiningsih, 2019). In addition, through e-learning students are able to access information in documents that have been provided at any time and repeatedly according to student needs so that they can provide experience in constructing and understanding material concepts (Rhamandica et al., 2016). The e-leaning that will be used is in the form of web-based learning.

The presence of this web-based interactive media will assist students in understanding learning equipped with video support features, animations and practical simulations. This web-based learning media will allow students to access the material and strengthen the material provided by the teacher. Student responses regarding web-based learning media are 100% fun and can help understand the subject matter (Haloho et al., 2019),The purpose of this study was to determine the effectiveness of web-based physics learning media assisted by the Wix platform on wave material for vocational high school students.

METHOD

This research was carried out at SMKN 1 Pakong, as the object of research was students of class X TKJ for the academic year 2021/2022. The instrument used in this research is in the form of a test consisting of multiple choice questions. The increase in the effectiveness of the web-based physics learning media assisted by the Wix platform is seen from the results of the students' pre-post test. Effectiveness can be found using the Normalized Gain (g) equation as follows:

$$(g) = \frac{(\bar{x}post) - (\bar{x}pre)}{Smax - (\bar{x}\ awal)} \quad \text{..... (3.3)}$$

(Sugiyono, 2017)

Furthermore, the value of Normalized Gain) obtained is translated according to the criteria for obtaining Normalized Gaid (g) as presented in table 1 below:

Table 1: Effectiveness Criteria

<g> gain %	**Criteria**
g > 0,7	High
0,3 ≤ g ≤ 0,7	Medium
g < 0,3	Low

(Sugiyono, 2017)

FINDING AND DISCUSSIONS

The effectiveness in this study can be seen in the results of the pre-test and post-test of students before and after using web-based learning media on wave material. The following can be seen the results of the normalized gain (g) test.

$$(g) = \frac{(\bar{x}\, post) - (\bar{x} pre)}{Smax - (\bar{x}\, awal)}$$

$$(g) = \frac{(76.84) - (42.63)}{100 - (42.63)}$$

$$(g) = 0.6$$

Based on the calculation of Nomalized Gain (g), obtained (g) = 0.6. Based on table 1, the results show that the web-based physics learning media assisted by the Wix platform is in the medium category. Web learning media can be used as a tool for learning at school and used to increase students' understanding of the material presented and be able to add independent learning activities (Hanum, 2013). Web-based learning media can take advantage of smartphones owned for learning at school and distance learning.

This web-based Learning Media assisted by the Wix Platform is also equipped with the PhEt feature so that students can do virtual laboratories even though learning is online. This virtual laboratory also helps students to better understand the concept of waves because it can be accessed anytime and anywhere according to student needs. The use of a PhEt-based virtual laboratory can improve students' higher-order thinking skills and soft skills (Rahem & Suprianto, 2018). The laboratory-based

learning process helps students in solving problems directly so that students are able to take the initiative themselves in building their knowledge of physics concepts (Umamah, Azkiyah, Andi & Suprianto, 2021).

CONCLUSION

The conclusion in this study is that the web-based physics learning media assisted by the Wix platform on the wave material developed can be said to be effective for class X TKJ SMKN 1 Pakong students.

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ICT BASE ASSESSMENT IN ELT

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INTRODUCTION

Now days, technology has a huge role in many fields, including education. Called as 21st century, computer is used as the vital media in completing some activities. Then, Indonesian government put Information and communication technology as one of Indonesia's education curriculum. In that case, ICT (information and communication technology) become the trend issue in education world and it has been used to facilitate the teachers and learners in all education levels.

Teaching and learning using a computer gives very powerful changes in all aspects, such as, the method, the media, the assessment, etc. Hartoyo (2008) stated in his book that a computer is a tool and medium that facilitates people in learning a language, although the effectiveness of learning depends totally on the users. It can conclude that, when people make good use of computer, people are good for it.

The growth of technology runs fast. The innovation in the English language learning is needed. Thus, some modern applications are developed to facilitate the teachers and learners. The application of modern technology represents a significant advance in contemporary English language teaching methods. Indeed, Ahmadi (2018) maintains that electronic teaching programs have become the predominant preferenceof instructors since they arguably boost positive student engagement with teachers and incentivize overall English language learning. ICT as the use of the modern application is used to upgrade the language teaching and learning aspects.

The main goal of the language teaching and learning is a language acquisition. This goal needs a tool called assessment. The language acquisition should be included four skills on it; listening, speaking, writing and reading. This assessment way also changed over time. In this era, computer is used as the main tool of assessment process, started from the test into the scoring. In fact, measuring language

proficiency is a complex process that necessitates the use of valid and reliable language testing tools. Language assessments take various forms depending on the skill or proficiency level being tested. Thus, the computer existence is very helpful.

Language is a need. Language is one of the vital terms in human life. Every human being communicates each other using language; verbal or non-verbal language. Many language definitions have proposed by many linguists. Aristotle explains that language is a speech sound produced by human beings to express their ideas, emotions, thoughts, desires, and feelings. Then, based on Derbyshire, language is undoubtedly a kind of communication among human beings. It consists primarily of vocal sounds, articulatory, systematic, symbolic, and arbitrary. These definitions shows that language is a complex thing. Every people needs a long process to acquire and understand the language.

Babies use a cry to express their feeling. Then, they will obtain the mother tongue from their environment. This condition shows us numerous ways of the language acquisition. The language will be obtained from listening, imitating, and practicing. However, in learning second language will be quite different. The second language learners may acquire the language in the formal education, non-formal education or learn it with self-taught. The teaching and learning process create some different ways, different technique and different method in each period. It is caused by many factors. One of the most influential thing is technology. This technology development pushes every people to be more creative and innovative in teaching and learning field. Language teaching and learning field is one of lifelong learning topic.

Now days, learning language is very simple and easy. Every teachers and learners able to communicate with the English native speakers to practice their English easily. Many platforms; YouTube, Instagram, Facebook and others are easily to be accessed. Everyone able to gather some information about English language easily. On the other hand, the formal education also uses the same way to learn English language. The teacher accesses some platforms to share the materials. This phenomena is related with ICT term.

Information and communications technology usually abbreviated as ICT, is often used as an extended synonym for information technology (IT), but is usually a more general term that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers, middleware as well as necessary software, storage- and audio-visual systems, which enable users to create, access, store, transmit, and manipulate information (Tamiliselvan, Sivakumar, Sevukan, 2012). In other words, ICT consists of IT as well as telecommunication, broadcast media, all types of audio and video processing and transmission and network based control and monitoring functions. The expression was first used in 1997 in a report by Dennis Stevenson to the UK government and promoted by the new National Curriculum documents for the UK in 2000 (Tamiliselvan et al, 2012).

Information and communication technology is the use of information in order to meet human need or purpose including reference to the use of contemporary devices such as the Internet. This definition shows that the use of ICT in language learning means conducting the language learning using internet. The teachers and learners able to communicate and access their learning material in the computer or mobile phone (A Mofareh, 2019). The latest facts are the face to face learning process in the class is changed to online meeting, pen and paper mostly unneeded, printed resources are changed into E-resources and others. They are the evidence that the ICT learning create some innovation in language and teaching. Then, it also happened to the assessment style.

Assessment is the process of identifying, gathering and interpreting information about students' learning. In English language teaching, assessment is used to measure the student’s language acquisition. It is group in to four skills, listening, writing, speaking and reading. Each skills has their own assessment style. Assessment involves using wide variety of methods and tools to evaluate, measure, and document the student learning. In short, assessment basically helps one to improve learning and also set direction for ongoing teaching and learning process.

TYPES OF ASSESSMENT

Generally, assessment is classified in to various types or approaches based on the purpose for which it is designed. They are as follows:

Formative Assessment: Formative assessment provides feedback and information during the instructional process, while learning is taking place, and while learning is occurring.

Summative Assessment: Summative assessment takes place after the learning has been completed and provides information and feedback that sums up the teaching and learning process.

Diagnostic Assessment: Diagnostic assessment can help you identify your students' current knowledge of a subject, their skill sets and capabilities, and to clarify misconceptions before teaching takes place. Knowing students' strengths and weaknesses can help you better plan what to teach and how to teach it.

Authentic Assessment: The term **authentic assessment** describes the multiple forms of assessment that reflect student learning, achievement, motivation, and attitudes on instructionally relevant classroom activities. It Emphasizes what students know, rather than what they do not know or requires students to develop responses instead of selecting them from predetermined options. An **authentic assessment** usually includes a task for students to perform and a rubric by which their performance on the task will be evaluated.

Performance Assessment: Performance assessment is one which requires students to demonstrate that they have mastered specific skills and competencies by performing or producing something.

KINDS OF ICT BASED APPLICATIONS FOR ASSESSMENT

a. Quizz

Qizz is an online formative assessment tool used to obtain information about how the class as a whole understands content material. It also allows teachers and students to create and use quizzes each other.

b. Rubistar

RubiStar is a free, Web-based tool designed to help teachers develop quality rubrics. It is one of several tools developed by ALTEC (http://www.altec.org) through the High Plains Regional Technology in Education Consortium (HPR*TEC), a ten-year initiative funded by the U.S. Department of Education (U.S. Department of Education, 2005).

c. Irubric

iRubric is an intuitive assessment system for developing rubrics, sharing, assessing and analyzing results. iRubric includes the largest gallery of rubrics and invented Click2 Grade for rapid scoring.

d. G-form

GFORM is a shortcut file for actual form file stored in the cloud. Clicking on GFORM file automatically opens Google Drive project in user's web browser. GFORM files are typically used for creating forms used in research or market surveys.

e. Edpuzzle

Edpuzzle is an online video editing and formative assessment tool that lets teachers cut, crop, and organize videos. But it does so much more, too. Unlike a traditional video editor, this is more about getting clips into a format that allows teachers to engage directly with students on a subject. It also has the capacity to offer assessments based on the content, and offers lots of controls that allow for the use of video even in more strict school scenarios.

f. Quizcreator

QuizCreator is a powerful quiz maker that lets trainers and educators create professional Flash-based quizzes and surveys with multimedia. Quickly design your assessment and publish online, then track the quiz results and receive insightful reports via Wondershare QuizCreator Online working seamlessly with QuizCreator.

THE USE OF ICT BASE ASSESSMENT IN ELT

Herington (2002) mentioned several advantageous of ICT (1) technology facilitates exposure to authentic language; (2) technology provides the access to wider sources of information and varieties of language; (3) technology gives the opportunity to people to communicate with the world outside; (4) technology allows a learner – centered approach; (5) technology develops learner's autonomy. In short, ICT help people in order to get information and to communicate each other in wider range.

The success of the ICT role in teaching and learning is according to human resources. The teacher' and learners' readiness is the most important thing. Operating the computer and the mobile application needs time. When ICT is used in the teaching and learning process, the teachers and the learners should prepare their new knowledge and skill in mastering the computer and mobile use.

The word "assessment" translates into multiple choice questions or writing for hours in a crowded exam hall. That is the previous definition of assessment and it has a certain place in our education. The huge advancements in computer-based testing are now redefining the possibilities of assessment, particularly in terms of what can be tested, how and when. These improvements mean that there are many more applications for both summative and formative testing, applications that even a couple of years ago would not have been possible.

Louella Morton, stated the top five trends that are changing how assessment is delivered:

1. Movement away from traditional assessment delivery methods.

2. The end of the road for pen and paper.

3. Much more engaging and effective assessment.

4. Increasing levels of automation.

5. Assessments are much more candidate centric.

However, these trends have a wide-ranging impact on many different educational institutes. Assessments should be an integrated part of learning and development and demonstrate an individual's ability to apply knowledge - rather than just a measure of knowledge at a given time. Using online exam software opens up a suite of useful tools to simplify creation, delivery and marking of a range of assessment types. The trends towards flexible delivery, engaging assessments, automation and a candidate-centric focus are helping organizations move to a model where assessments are far more effective, and where the candidate experience is both positive and engaging.

The writer has been used the Gform to assess the students' understanding in some material, such as grammar and reading. She combined the students' response in doing the test when using the Gform application and using the paper test. It is concluded that the students are more interesting and relaxed when doing the test. Then, they were very excited in knowing their score after finishing the test. On the other hand, the students are easier to check their falls in the test.

Erina in her review for Quizzing application explained that the Quizizz application can be used as an alternative application for teachers to carry out formative assessments. Based on her opinion, this application is easy enough for the teacher to operate as a host / question maker, on the other hand it's also easy enough for students to access and perform quizzes via quizizz. Moreover, this application is very suitable for developing reading, writing, and higher order thinking skills. In short, quizizz will be very appropriate if used as a media formative assessment by teachers in English Language Teaching.

As explained before, some application can be an alternative for assessing the students' ability. The ICT role in language learning assessment provide some positive effects for the institution, teachers and the learners.

1. It increases student motivation for facing the test
2. it can also improve student learning outcomes, because the games feature used can stimulate student interest in learning

3. The information required will be more quickly and easily accessible for educational purposes.
4. Innovation in learning is growing in the presence of e-learning innovations that further facilitate the educational process.
5. Progress of ICT will also allow the development of virtual classroom or classroom-based teleconference that does not require the educator and learners are in one room.
6. System administration in an institution will be more easily and smoothly because of the application of ICT systems.

CONCLUSSION

In this new era, the growth of technology is unstoppable. Internet connection is a need. Computer and mobile hold the vital role in every field, including education. That's called as Information and Communication technology (ICT). English language Teaching and learning process have various development, especially in assessing the students' ability. Some applications are created and developed in order to facilitate the teachers in assessing their student's English skills. This ICT base assessment has good impact for the teachers in choosing the kinds of assessment, creating the assessment and scoring. For the students, it also gives very good motivation and fun felling when they have an assessment.

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INTRODUCING INFORMATIOAN AND COMMUNICATION TECHNOLOGIES (ICT) TO YOUNG LEARNERS

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INTRODUCTION

In globalization era, the use of technology cannot be separated from human life. Many activities carried out by humans from morning to night all depend on the role of this technology. Therefore, we must admit that technology plays an important role in everyday life. Many studies reveal the important role of technology in certain fields.

In the world of education, Information and Communication Technology is an interesting learning medium, because with Information and Communication Technology it will be easier for a teacher to transfer knowledge to their students in a fun way. Of course, the introduction and use of technology is highly recommended to students so that they can easily absorb a very broad knowledge. This introduction can be done to early childhood to adult children.

Montessori (1949) stated that early childhood is an individual who is undergoing a very rapid and fundamental development process for the next life. In the age range 0-6 years, early childhood experiences rapid growth and development in various aspects. Starting from the development of brain cells to motor muscles of children.

In this case, it is possible to make Information and Communication Technology as a medium in the learning process for early childhood in developing their potential. As mentioned by Syafitri & Sari (2015) that using learning media that is combined with sound, images, animation and other digital elements that can be displayed more attractively can increase children's enthusiasm to learn and listen to the material presented.

Based on the above explanation, the magnitude influence of technology on human life, it is necessary to introduce Information Communication Technology, especially for early childhood so that their ability development is achieved perfectly.

DISCUSSION

The Characteritics of Young Learner

Early child is an individual figure who is undergoing a very rapid development process. In this stage, children are in "golden age" where they will accept what they learn. They are always active, creative, and enthusiastic, and have a very high curiosity about what they see and hear. Young learner usually learn by referring to the principle of play. Playing is an activity carried out that produces information, provides pleasure or develops imagination in children (Sudono, 2000).

According to Santrock (2003) playing is a fun activity that involve for its own sake. Harlock (2008) explains that play is an activity which is done for the pleasure it engenders, without considering the result in the end of activity. Playing is done voluntarily, so there is no coercion or pressure from outside and also because not of obligation.

Through playing, demands for children's motoric development, cognitive, creativity, language, emotion, social interaction, values, and attitudes to life can be met. When children are playing, they will imagine and issue the ideas stored in them. They will express their knowledge about the world around him. Through playing, children have more opportunities to explore so that understanding of concepts and basic knowledge can be understood by children easily.

While learning is a mental or psychical activity that takes an active interaction with environment that increase knowledge, understanding, skills and attitude values (Darsono, 2000). Learning is a process carried out by a person to acquire various learnings, skills, and attitudes. Result in changes in knowledge, understanding, and attitudes and these changes are new experiences that occurs because of a conscious effort, so that it will have implications for the function of life.

From the explanation above, it can be understood that, playing while learning is a play activity in which there are elements of learning. Through playing, demands for the developmental needs of the motoric, cognitive, creativity, language, emotional, social interactions, values, and attitudes to life can be fulfilled. When playing, children will imagining and releasing the ideas that are stored in him. Children can express the knowledge he has about the world around him. Through play activities, children have more opportunities to explore, so that their understanding of concepts and basic understanding of knowledge can be understood by children more easily.

Definition of Information and Communication Technologies

Information and communication technology is a term which includes all technical equipment for processing and conveying information. ICT includes two aspects, namely information technology and communication technology.

Information technology is the study or use of electronic equipment, especially computer to store, analyze and distribute any information, including words, numbers and pictures. As stated by Lucas in Munir (2008) said that information technology is forms of technology applied to process and transmit information in electronic forms, microcomputers, mainframe computers, barcode readers, software transaction processing, spreadsheet tools and communication and networking equipment are example of information technology. The information conveyed is in the form of electronic messages.

While communication technology is a technological device consisting of: hardware, software, processes and systems, which are used to assist the communication process, which aim for successful communication. Information technology includes everything related to the process, use as a tool, manipulation, and management of information. So that, communication technology is everything related to the use of tools to process and transfer data from one device to another. Therefore, information technology and communication technology are two inseparable concepts.

In short, it can be understood that information technology is more on processing systems information while communication technology serves to transmit

information. Another theory formulate a definition of information and communication technology as something that allows we obtain information to communicate with each other or to have an influence on the environment in which electronic and digital equipment is used.

Introducing ICT to Young Learner

Learning by using information communication technology in early childhood has many perceptions, including: use of information communication technology as a media for learning or teaching information communication technology to them. The teaching and learning process is essentially communication process, namely the learning process of delivering messages from the source of the message through certain media to the recipient of the message.

Technology is like two different sides of a coin, which has a positive side and negative. So, the implementation of technology will be different for each age of children's development. Here are ways to introduce technology to early childhood based on the age of children (Susanto 2017):

a. **Ages 0–2 years:** At this age, children begin to learn to hear and hear the surroundings, from the stimulation through movement, and voice. Then children begin to imitate when they begin to learn speaking.

Giving information technology to this age can be done through multimedia by playing spiritual songs or children's songs. Introducing colors through multimedia by playing cartoons, which are contain education. This activity help children's character building.

b. **Ages 3-4 years:** At this age, children begin to use almost complete sentence, this is can be seen from the way they ask something. According to Piaget, the way children asking questions show a child's cognitive development. In a child who comes from an authoritarian parental background, children learn less to speak, than in a democratic family, where children not only learn to "hear" but also "heard".

In this age (3-4 years) it is important to provide information technology through multimedia such as at the age 0-2 years but the way of learning is slightly increased according to the age of the child who has been able to receive more stimulation. For example starting to recite holy Quran using multimedia, introducing religious cartoon or movie through multimedia. Of course parents need assistance so that it can be seen how far the child is able to learn. The more opportunities a child has to learn to speak, it help children grow their self-confidence so that at their school age can introduce and express themselves verbally.

c. **Ages 5–6 years:** At this age, the introduction of the ICT world has increased. The introduction can be in the form of an introduction to computer hardware (hardware) that can be seen and held directly by the child, for example: CPU, Monitor, Mouse, Keyboard and Printer. This introduction is also equipped with an explanation of the function of each tool by direct practice (learning by doing).

d. **Ages 7–8 years:** at this age, introduction to the ICT has entered the program level interactive, where children can interact with learning application programs.

Negative Effects of Computers on Early Childhood

In addition to the benefits that have been given by technological developments, especially computer technology in this era of globalization, there are also negative impacts from these developments as follows:

a. Computers can cause children's eyes to hurt if they are too long in front of the computer.

b. Computers can also cause children to be lazy to learn, if children are familiar with online games.

c. It is very likely that children consume games that feature elements of violence without their parents knowing.

d. Children will lose playing time with friends of their age which will make the child's social life lack of balance.

e. Children also become lazy to study because a lot of time is spent in front of the computer, resulting in decreased academic achievement.

f. Internet access will also have a negative impact even though in fact, being able to access the internet is a good start for the development of children's insights. Children will be threatened by the amount of bad information that floods the internet.

g. Disturbing health, for example, repetitive stress or strain injury, eye fatigue and headaches, back and neck pain, and so on.

Making Computers Safe and Beneficial for Children

Considering the use of computers is something that cannot be avoided at this time and in the future, but children must be introduced to computers even though there are bad effects that can be caused, it is better for us to develop strategies in introducing computers to children. Here are some tactics that can be done in introducing computers to children.

a. Introduce computers to children according to their age. Introduction for toddlers, can be started by guiding him to touch the computer, holding the mouse, typing the letters on the keyboard.

b. Accompany children when they use the computer. Direct and guide them in warm communication. It's a good idea to use a password so that your child cannot use the computer without supervision.

c. Make your own curriculum at home. For example, do not show all the application programs that you will give to children. Give one by one, step by step.

d. Educators and parents should continue to develop their abilities and skills in using computers. Sometimes what happens is the opposite, children are more sophisticated than their parents. This can result in supervision and guidance being limited to the ability of educators or parents only. Be your child's first source of these developments.

e. Make an agreement with your child about what you can and can't do with the computer. Do not make your own rules, involve children in making rules so that children can also feel the responsibility to implement every rule that has been made together.

f. The computer should not be placed in the child's private room, because this will make it difficult for parents to supervise their children.

g. Computers also have certain effects on a person's physique. Pay attention to spatial issues, lighting, electrical hazards, sitting position, table and chair height, and so on. So that children are really in a really comfortable, safe and healthy state when using the computer.

CONCLUSION

Based on the description above, it can be concluded that, currently we cannot break away from the development of information and communication technology (ICT), because it has become a part of life and necessity. This pattern of life has an impact on development of education that utilizes ICT in particular as a learning medium.

As an effort to develop individual abilities in the practical use of ICT it is necessary to introduce it from an early age. The development of early childhood abilities in ICT must continue to be carried out according to the concept

Early childhood learning is learning while playing and playing while learning. Theory as well as the teaching materials provided must also be varied and not monotonous with various characteristics of ICT as a learning medium so that the imagination of the child can develop optimally as they age. So that more improve their intellectual and emotional abilities.

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CONCEPT OF FORSTER/FLUORESCENCE RESONANCE ENERGY TRANSFER (FRET) TECHNIQUE

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ABSTRACT

Forster/Fluorescence Resonance Energy Transfer (FRET) is a physical phenomenon which involves radiation-less energy transfer (via long-range dipole-dipole interaction) from excited donor fluorochrome to another molecule or acceptor. FRET relies on distance-dependent energy transfer (donor and acceptor) and can only occur when the distance between donor and acceptor is less than 10 nm. Due to sensitivity to distance, FRET is used in studying molecular interactions. This chapter aims to discuss the concept and applications of FRET in a cryptic way.

INTRODUCTORY CONCEPT

FRET is a fluorescence microscopy technique. Fluorescence involves the absorption of light energy by fluorophore molecules and the emission of energy of longer wavelengths. If this emission, overlaps the absorption spectrum of the acceptor chromophore, radiation-less transfer of energy takes place, provided the two probes are in close vicinity with each other. This is the process of **Resonance Energy Transfer** that was first postulated by Theodore Forster, thus, the technique was named. However, scientifically, Fluorescence Resonance Energy Transfer is commonly used, and the process involves the non-radiative transfer of energy between two fluorescent probes. (Fig. 1).

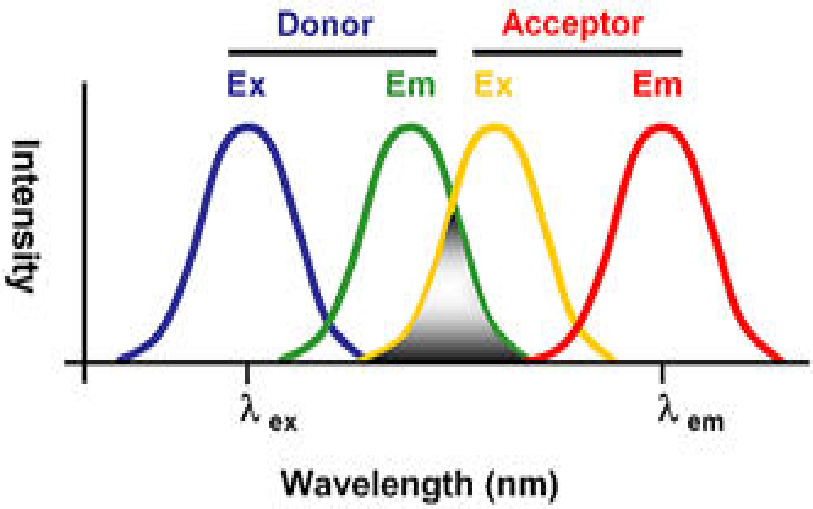

Fig. 1: Emission and Absorption spectrum of a donor probe and absorption spectrum of an acceptor probe. Emission spectrum of donor probe overlaps with absorption spectrum of acceptor probe. Ex: Excitation; Em: Emission

Principle of Fluorescence Energy Transfer (FRET)

The principle of FRET is based on Resonance Energy Transfer which relies on the transfer of excitation energy of donor fluorochrome to nearby acceptor chromophore via long-term dipole-dipole interaction in a non-radiative fashion as shown by the Jablonski diagram (Fig.2).

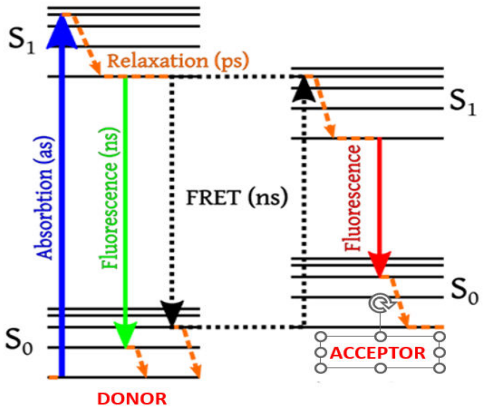

Fig. 2: Jablonski Diagram showing donor absorbing photon and jumping from ground state to excited state (S_0 to S_{10}). Green colour shows emission of fluorescence upon falling from excited state. Dashed black arrow shows energy transfer in FRET.

In the phenomenon of FRET, no photon is emitted (non-radiative) and is analogous to the behavior of coupled oscillators, such as pair of tuning fork vibrating at same frequency. Hence providing information concerning to the orientation of donor and acceptor molecule.

Requirements Needed for FRET to Occur Successfully:

1. FRET requires two probes - Donor which need to be fluorescent and an acceptor. The acceptor does not need to be fluorescent.
2. The fluorescent molecule must be within 10 nm of each other else there will be no energy transfer. This is important for FRET, as it can be used to determine how close together certain molecules are.
3. The two fluorescent molecules must have overlapping spectra so that energy from one can excite the other.
4. The fluorescent molecules must not be oriented perpendicular to each other. Energy transfer can only take place when they are parallel to each other. (Fig. 3B)
5. Another additional requirement of FRET is that the lifetime of the fluorescent donor must be of sufficient duration for the event to occur.

The Forster Equation

According to the theory of Forster Energy Transfer, the efficiency of energy transfer is given by the equation:

$$E_{FRET} = \frac{1}{1 + \frac{(r)^6}{(R_0)^6}}$$

where r is the donor-acceptor separation distance

R_O is Forster radius

6. The above equation states that, the efficiency of energy transfer depends upon donor-acceptor separation distance (r) with an inverse 6^{th} power law due to the dipole-dipole coupling mechanism. Moreover, when the donor-acceptor distance

(r) is equal to the Forster radius, then the transfer efficiency is 50%. Thus, the Forster radius is the characteristic distance when 50% FRET efficiency occurs. (Fig. 3A)

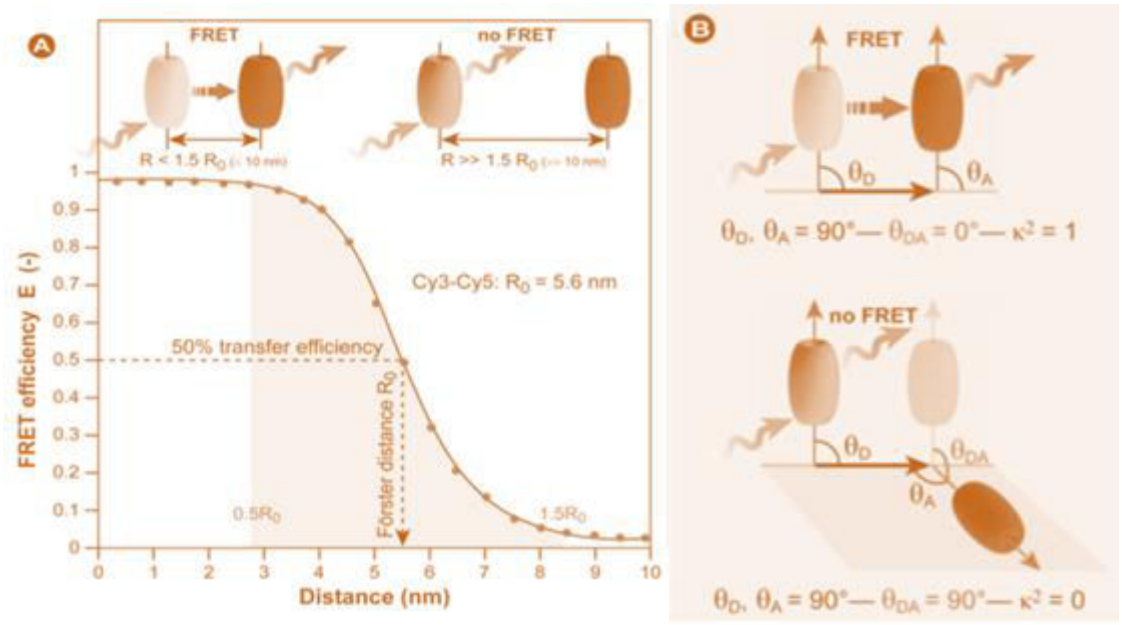

Fig. 3 A) Concept of FRET, when the distance between fluorochrome is more than 10 nm, No FRET is observed as only donor fluorochrome is excited, the acceptor is too distant from it. However, when the acceptor is closer to the excited donor, energy is transferred non-radioactively from donor to acceptor and FRET is observed. In this case, donor emission decreases and acceptor emission detected easily.

B) Orientation of fluorochromes, when fluorochromes are parallel to each other, FRET is detected, when the fluorochromes are perpendicular to each other, no FRET is detected. Therefore, FRET helps in determining the orientation between molecules

FRET Couplers

In the earlier studies, organic fluorochrome dyes were used as couplers due to their high emission power, high extinction coefficient and high photon count per fluorochrome as compared to dim fluorescent probes. But since the organic dyes

lack the benefit of genetic coding and direct expression in the cell, fluorescent probes are commonly used (FPs).

The first truly effective FRET coupler which was devoid of problems like poor photophysical properties, and ineffective overlap integrals, consisted of CFP as donor and YFP as acceptor. CFP (Cyan Fluorescent protein) gets excited at 433 nm of wavelength and emit a longer wavelength of 475 nm on the other hand YFP (Yellow fluorescent protein) gets excited at 475 nm and emits a longer wavelength of 528 nm. When they couple together, the emission spectrum of CFP overlaps with the absorption spectrum of YEP and therefore when CFP is excited with 433 nm of wavelength it transfers its energy to YEP which emits a wavelength of 528 nm. (Fig. 4)

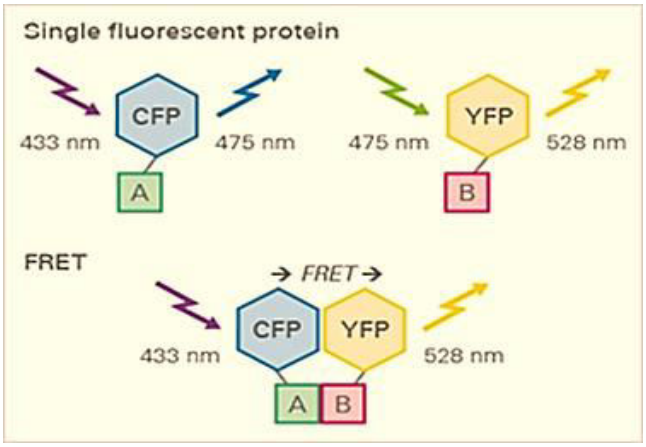

Fig. 4: FRET coupler

Other popular FRET pair includes CFP/Discosoma Red (ds RED), Blue Fluorescent protein (BFP)/Green Florescent Protein (GFP), GFP or YFP and dsRED and even a combination such as Alexa 488 as a donor and red emitting dyes such as CY 3, CY5, CY5.5 AND CY7 act as an acceptor.

Application of FRET

FRET is an important microscopy technique that can be used as a spectroscopic ruler to measure distance and detect molecular interaction. Over the past years, applications of FRET have expanded in many biological fields, some of which are listed below.

- FRET has been an important imaging technique in visualizing the cellular compartmentalization and functioning of a living cell. (Jares and Jovin, 2003).
- Intermolecular and intramolecular FRET between a spectrally overlapping spectrum of variants of GFP fused to two different proteins or within different sites of the same protein provides real-time imaging to detect **protein-protein interaction** and **protein conformational changes**. (Truong and Ikura, 2001). FRET is an important technique for quantitatively determining enzyme kinetics.
- FRET microscopy techniques are essential in analysing the action of bacterial toxins in host cells. (Majoul, 2004)
- The FRET technique has been used to detect chemotaxis signaling pathways in bacteria in vivo. (Sourjik et al., 2007)
- FRET is a sensitive technique and can be used to detect PTH- induced activation of caspase- 3 which is considered as the last stage in the cell apoptosis pathway. (Wu et al., 2006)
- Many aspects of the hormone receptor pathway that are crucial for controlling signal transduction in the endocrine pathway can be monitored using live cell imaging techniques like FRET. (Eidne et al., 2002)
- FRET has been developed to monitor the activation and signaling of G-protein coupled receptors. This technique spans the entire mechanism of binding of ligands to the receptor down to the second messenger generation thus allowing the determination and visualisation of a cell signaling pathway. (Lohse et al., 2012).
- FRET can be used to study the fluidity of plasma membrane, membrane lipid-protein interaction and protein-protein interaction. It can also be used for the detection and evaluation of the size of lipid rafts and other domains. (Loura and Prieto, 2011)

- FRET is a potent technique for determining the surface density of the plasma membrane of the cell. (Fung and Stryer, 1978)
- A potent application of the FRET technique is the development of FRET biosensors, such as the fusion protein of ECYP and EYEP which respond to change in certain cellular conditions such as conformational change resulting in a change in the FRET signal. (Borst and Visser, 2010) (Figure 5)

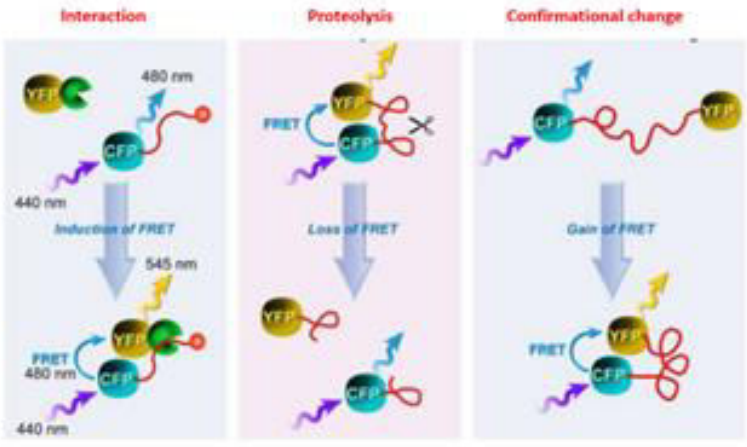

Fig. 5: FRET helps in studying protein-protein interaction in live cells. FRET Signaling - Interaction, proteolysis and conformational change of the protein in the cell leads to change in FRET Signal.

- Lu et al. (2014) used FRET to study the response of Nanoparticles to the change in the Ph in the intestinal tract and the delivery of protein across the intestinal epithelial cell barrier.

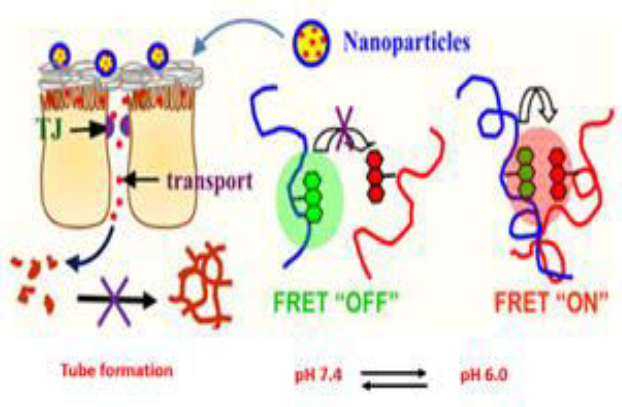

Fig. 6: Change of pH effect on nanoparticle: From increase of pH from 6 to 8, there is change in binding affinity of charged particles which decreases resulting in an OFF FRET signal. The nanocarrier triggered the opening of the intestinal epithelial tight junction and enhanced the permeation of released protein through the intestinal epithelial barrier. Thus, change in pH can be used to study the pH responsiveness of nanoparticles and to control the release of anti-angiogenic protein. Image from Ying-lu et al.(2014)

- Optical imaging techniques like FRET have been widely used to study protein-protein interaction during cancer progression, anti-cancer Drug delivery and cancer research. (Shilpi et al. 2014)
- The living cells are exposed to a variety of mechanical stress and their ability to sense and respond to molecular forces can be studied using FRET biosensors. Moreover, FRET biosensors allow for the measurement of molecular force. (Cost et al. 2014)
- FRET is very successful in studying the interaction of nanomedicine with biological systems and revealing changes in cells after the delivery of nanomedicines. Thus, FRET is an important tool which can be very useful guide in the development of nanomedicine and early diagnosis of disease. (Chen et al. 2019; Kaeokhamloed et al., 2022).
- FRET probes can be used to detect small molecules such as anions, cations, and uncharged molecules. With the binding of these molecules with fluorescent probes, their structure changes and can turn on or off the FRET signal. (Luling et al. 2020) Figure 7

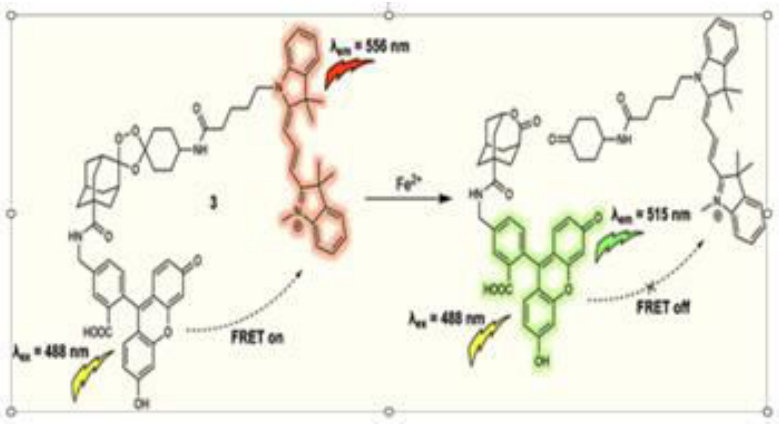

Fig. 7 Radiometric Detection of Fe^{2+} using 5 aminoethyl fluorescein/cy3 (donor/acceptor probe). In absence of Fe^{2+}, FRET signal is on, in the presence of Fe^{2+}, confirmational changes occur in the probe and thus FRET signal is off. Therefore, Endogenous change of Fe^{2+} concentration can be traced in the living cell to explore the role of Fe^{2+} in the biological system. Image from Luling et al., 2020)

- FRET-based biosensors are an effective analytical tool used in the field of biomedicine, pharmacology and food science. A variety of biosensors have provided comprehensive insight into the underlying pathological condition in live cells, tissues, and organisms. Thus, FRET-based biosensors allow for accurate, rapid diagnosis and propose strategies for the treatment of diseases. (Imani et al.2021)

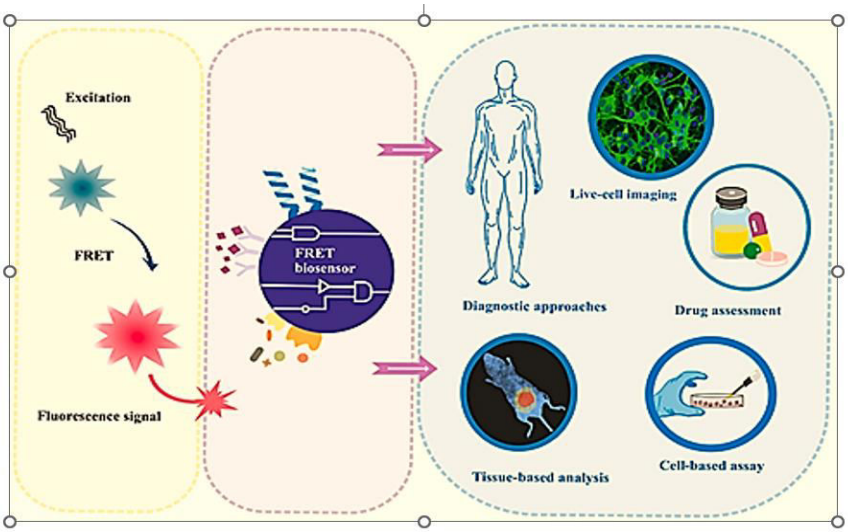

Figure 8: Application FRET biosensors

- Fluorescence resonance energy technique has been emerging as the most important analytical tool to recognize and quantify the contamination of heavy metals on food and agriculture-related matrices. This review might give important insight for developing early effective warning strategies to safeguard public health and food safety. (Shen et al., 2022)

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PHYSICS REVOLUTIONS OF 2022: EXPLORE THIS YEAR'S BEST PHYSICS RESEARCH

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The Advances of the Year for 2022, which span everything from quantum and medical physics to astronomy and condensed matter. Breakthroughs selected through hundreds of research updates published on the website this year across all fields of physics. In addition to having been selected, selections must meet the preferred criteria:

- Significant advance in knowledge or understanding
- Importance of work for scientific progress and/or development of real-world applications
- Of general interest to Physics fraternity mostly from Asia.

Criterion based selected advances for 2022 are listed and discussed below in particular order.

1: Ushering in a New Era for Ultracold Chemistry

To Bo Zhao, Jian-Wei Pan and colleagues at the University of Science and Technology of China (USTC) and the Chinese Academy of Sciences in Beijing; and independently to John Doyle, Professor of Physics and colleagues at Harvard University in the US, for creating the first ultracold polyatomic molecules.

John Doyle's research centers on using cold molecules for science ranging from bio-analysis to particle physics to quantum information. His group studies fundamental collisional processes in atoms and molecules and develop tools to achieve full quantum control over increasingly complex molecular systems. He is also currently working to realize new techniques to trap and study processes in polyatomic molecules **[1]**.

Although physicists have been cooling atoms to a fraction above absolute zero for more than 30 years, and the first ultracold diatomic molecules appeared in the mid-2000s, the goal of making ultracold molecules containing three or more atoms had proved elusive.

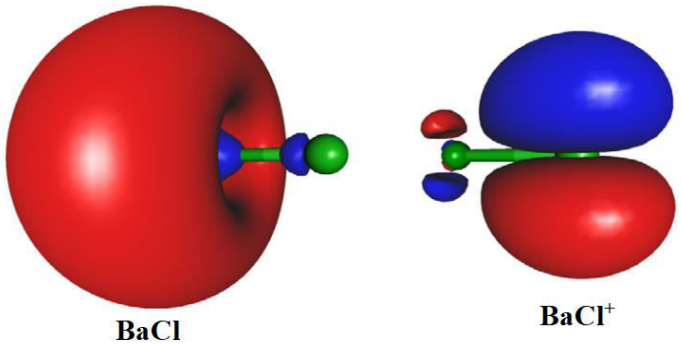

Fig. - 1: BaCl Ultracold Molecule

Using different and complementary techniques, the USTC and Harvard teams produced samples of triatomic sodium-potassium molecules at 220 nK and sodium hydroxide at 110 μK, respectively. Their achievement paves the way for new research in both physics and chemistry, with studies of ultracold chemical reactions, novel forms of quantum simulation, and tests of fundamental science all closer to being realized thanks to these multi-atom molecular platforms **[2]**.

The more detailed for a new era for ultracold chemistry is presented as: "Ultracold triatomic molecules herald a new frontier for the three-body problem" and "Laser cooling of polyatomic molecules brings ultracold chemistry into the spotlight".

Production of ultracold polyatomic molecules with strong polarity by laser cooling: A detailed theoretical study on CaNC and SrNC **[3]**. Laser cooling molecules to the ultracold regime is the prerequisite for many novel science and technologies. It is desirable to take advantage of theoretical approaches to explore polyatomic molecular candidates, which are capable of being cooled to the ultracold regime. In this work, we explore two polyatomic candidates, CaNC and SrNC, which are suitable for laser cooling. These molecules possess impressively large permanent dipole moments (~6 Debye), which is preferred for applications using an external

electric field. High-level ab initio calculations are carried out to reveal electronic structures of these molecules, and the calculated spectroscopic constants agree very well with the available experimental data. For each molecule, the Franck-Condon factor matrix is calculated and shows a diagonal distribution. The radiative lifetimes for CaNC and SrNC are estimated to be 15.5 and 15.8 ns, respectively. Based upon the features of various electronic states and by choosing suitable spin-orbit states, we construct two feasible laser cooling schemes for the two molecules, each of which allows scattering nearly 10000 photons for direct laser cooling. These indicate that CaNC and SrNC are excellent ultracold polyatomic candidates with strong polarity **[3]**.

2: Observing the Tetraneutron

To Meytal Duer at the Institute for Nuclear Physics at Germany's Technical University of Darmstadt and the rest of the SAMURAI Collaboration for observing the tetraneutron and showing that uncharged nuclear matter exists, if only for a very short time.

Comprising four neutrons, the tetraneutron was spotted at the RIKEN Nishina Centre's Radioactive Ion Beam Factory in Japan. The tetraneutrons were created by firing helium-8 nuclei at a target of liquid hydrogen. The collisions can split a helium-8 nucleus into an alpha particle (two protons and two neutrons) and a tetraneutron.

By detecting the recoiling alpha particles and hydrogen nuclei, the team worked out that the four neutrons existed in an unbound tetraneutron state for just 10−22 s. The statistical significance of the observation is greater than 5σ, putting it over the threshold for a discovery in particle physics. The team now plans to study the individual neutrons within tetraneutrons and look for new particles containing six and eight neutrons.

The more detailed for Observing the tetraneutron is presented as: "Elusive tetraneutron is discovered at Japanese lab".

Meytal Duer discovers isolated multi-neutron system. ELEMENTS' Early Career Researchers Representative Dr. Meytal Duer and Principal Investigator Prof. Thomas Aumann from TU Darmstadt just published an article in Nature that describes the discovery of an isolated multi-neutron system. So far, only neutron stars were known to produce chargeless nuclear systems. Now, for the first time, Duer and colleagues were able to create the isolated four-neutron system at the Radioactive Ion Beam Factory at RIKEN (Japan). The key success factor was the employment of a knockout reaction at large momentum transfer with a radioactive high-energy ^{8}He beam **[4]**.

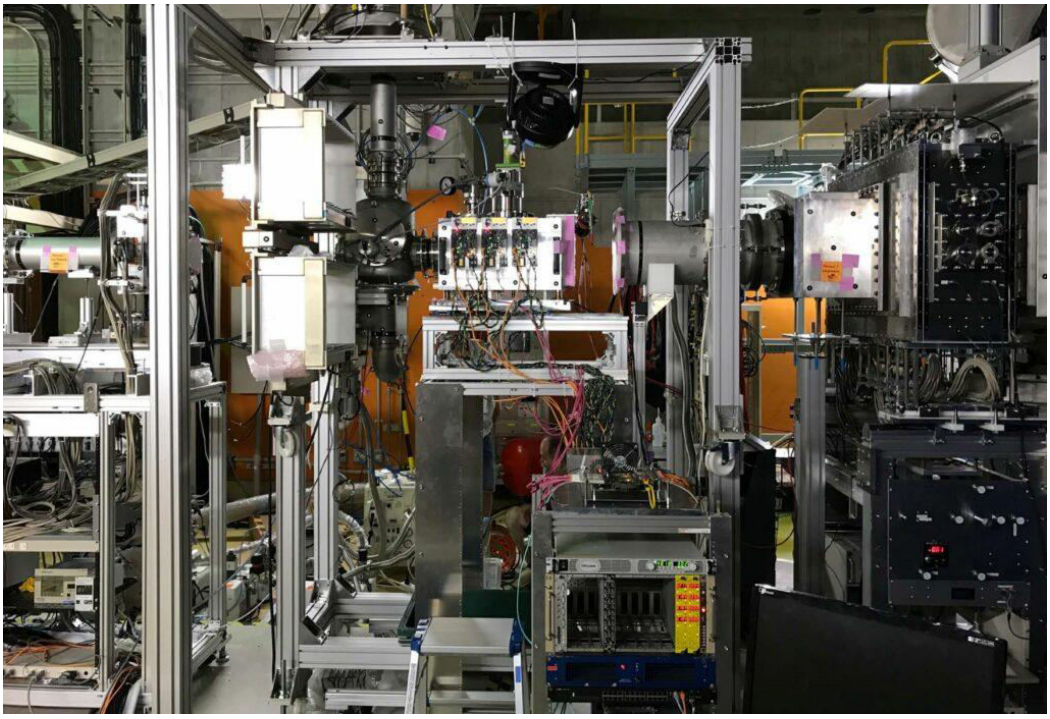

Fig.- 2: Experimental setup around the liquid hydrogen target that was developed by TU Darmstadt and TU München.

The experiment has been carried out at the Radioactive Ion Beam Factory RIBF at RIKEN (Japan) by a large international research team. Significantly involved were besides TU Darmstadt, scientists from TU Munich, the RIKEN Nishina Center, and the GSI Helmholtz Center for Heavy-ion Research. The experiment yielded an unambiguous signal for the first observation of the Tetra Neutron. The result has been published in the current issue of "Nature".

The building blocks of atomic nuclei are nucleons, which exist as two kinds, the neutral neutrons and the charged protons, representing the two isospin states of the nucleon. To our present knowledge, nuclei made of neutrons only are not existing as bound nuclei. The only bound systems known made of almost only neutrons are neutron stars, which are very compact high-density objects in the universe bound by the gravitational force with typical diameters of around 10 kilometers. Atomic nuclei are bound by the nuclear strong force with a preference to balance neutrons and protons, as known for the stable nuclei we find on earth.

3: Super-Efficient Electricity Generation

To Alina LaPotin, Asegun Henry and colleagues at the Massachusetts Institute of Technology and the National Renewable Energy Laboratory, US, for constructing a thermophotovoltaic (TPV) cell with an efficiency of more than 40%.

The new TPV cell is the first solid-state heat engine of any kind to convert infrared light into electrical energy more efficiently than a turbine-based generator, and it can operate with a broad range of possible heat sources. These include thermal energy storage systems, solar radiation (via an intermediate radiation absorber) and waste heat as well as nuclear reactions or combustion. The device could therefore become an important component of a cleaner, greener electricity grid, and a complement to visible-light solar photovoltaic cells.

The more detailed for Super-efficient electricity generation is presented as : “Thermophotovoltaic cells top 40 per cent efficiency”.

The first thermophotovoltaic cells with an efficiency of more than 40% – higher than any existing. Thermophotovoltaics (TPVs) convert predominantly infrared wavelength light to electricity via the photovoltaic effect, and can enable approaches to energy storage, and conversion– that use higher temperature heat sources than the turbines that are ubiquitous in electricity production today. Since the first demonstration of 29% efficient TPVs (Fig.) using an integrated back surface reflector and a tungsten emitter at 2,000 °C (ref.), TPV fabrication and performance have improved,. However, despite predictions that TPV efficiencies can exceed 50%

(refs. ,,), the demonstrated efficiencies are still only as high as 32%, albeit at much lower temperatures below 1,300 °C (refs. –). Here we report the fabrication and measurement of TPV cells with efficiencies of more than 40% and experimentally demonstrate the efficiency of high-bandgap tandem TPV cells. The TPV cells are two-junction devices comprising III–V materials **[5]**.

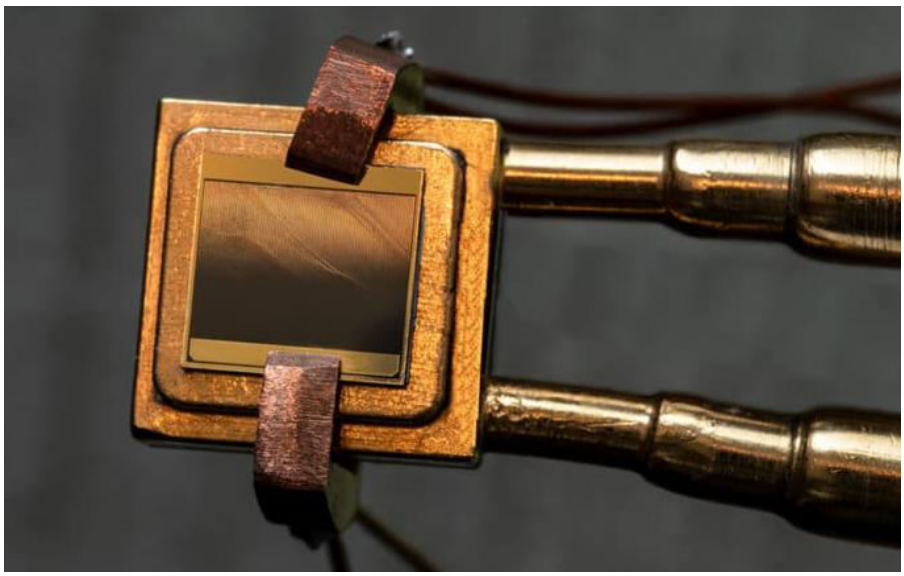

Fig.- 3: A thermophotovoltaic (TPV) cell mounted on a heat sink designed to measure the TPV cell efficiency

4: The Fastest Possible Optoelectronic Switch

To Marcus Ossiander, Martin Schultze and colleagues at the Max Planck Institute for Quantum Optics and LMU Munich in Germany; the Vienna University of Technology and the Graz University of Technology in Austria; and the CNR NANOTEC Institute of Nanotechnology in Italy, for defining and exploring the "speed limits" of optoelectronic switching in a physical device.

The team used laser pulses lasting just one femtosecond (10−15 s) to switch a sample of a dielectric material from an insulating to a conducting state at the speed needed to realize a switch that operates 1000 trillion times a second (one petahertz). Although the apartment-sized apparatus required to drive this super-fast switch means it will not appear in practical devices any time soon, the results imply a

fundamental limit for classical signal processing and suggest that petahertz solid-state optoelectronics is, in principle, feasible.

The more detailed for the fastest possible optoelectronic switch is presented as: "Quantum physics sets a speed limit for fastest possible optoelectronic switch"

Optoelectronic switches can operate up to 1000 trillion times a second – a rate of 1 petahertz.

The speed limit of optoelectronics:-

Light-field driven charge motion links semiconductor technology to electric fields with attosecond temporal control. Motivated by ultimate-speed electron-based signal processing, strong-field excitation has been identified viable for the ultrafast manipulation of a solid's electronic properties but found to evoke perplexing post-excitation dynamics. Here, we report on single-photon-populating the conduction band of a wide-gap dielectric within approximately one femtosecond. We control the subsequent Bloch wavepacket motion with the electric field of visible light. The resulting current allows sampling optical fields and tracking charge motion driven by optical signals. Our approach utilizes a large fraction of the conduction-band bandwidth to maximize operating speed. We identify population transfer to adjacent bands and the associated group velocity inversion as the mechanism ultimately limiting how fast electric currents can be controlled in solids. Our results imply a fundamental limit for classical signal processing and suggest the feasibility of solid-state optoelectronics up to 1 PHz frequency **[6]**.

5: First-in-Human FLASH Proton Therapy

To Emily Daugherty from the University of Cincinnati in the US and collaborators working on the FAST-01 trial for performing the first clinical trial of FLASH radiotherapy and the first-in-human use of FLASH proton therapy.

FLASH radiotherapy is an emerging treatment technique in which radiation is delivered at ultrahigh dose rates, an approach that is thought to spare healthy tissue

while still effectively killing cancer cells. Using protons to deliver the ultrahigh-dose-rate radiation will allow treatment of tumours located deep inside the body.

The trial included 10 patients with painful bone metastases in their arms and legs, who received a single proton treatment delivered at 40 Gy/s or greater – some 1000 times the dose rate of conventional photon radiotherapy. The team demonstrated the feasibility of the clinical workflow and showed that FLASH proton therapy was as effective as conventional radiotherapy for pain relief, without causing unexpected side effects.

The more detailed is presented as: "First trial in humans reveals promise of FLASH proton therapy"

Proton FLASH Radiotherapy for the Treatment of Symptomatic Bone Metastases: The FAST-01 Nonrandomized Trial:- Importance: To our knowledge, there have been no clinical trials of ultra-high-dose-rate radiotherapy delivered at more than 40 Gy/sec, known as FLASH therapy, nor first-in-human use of proton FLASH.

Objectives: To assess the clinical workflow feasibility and treatment-related toxic effects of FLASH and pain relief at the treatment sites.

Design, setting, and participants: In the FAST-01 nonrandomized trial, participants treated at Cincinnati Children's/UC Health Proton Therapy Center underwent palliative FLASH radiotherapy to extremity bone metastases. Patients 18 years and older with 1 to 3 painful extremity bone metastases and life expectancies of 2 months or more were eligible. Patients were excluded if they had foot, hand, and wrist metastases; metastases locally treated in the 2 weeks prior; metal implants in the treatment field; known enhanced tissue radiosensitivity; and implanted devices at risk of malfunction with radiotherapy. One of 11 patients who consented was excluded based on eligibility. The end points were evaluated at 3 months posttreatment, and patients were followed up through death or loss to follow-up for toxic effects and pain assessments. Of the 10 included patients, 2 died after the 2-

month follow-up but before the 3-month follow-up; 8 participants completed the 3-month evaluation. Data were collected from November 3, 2020, to January 28, 2022, and analyzed from January 28, 2022, to September 1, 2022.

Interventions: Bone metastases were treated on a FLASH-enabled (≥40 Gy/sec) proton radiotherapy system using a single-transmission proton beam. This is consistent with standard of care using the same prescription (8 Gy in a single fraction) but on a conventional-dose-rate (approximately 0.03 Gy/sec) photon radiotherapy system **[7]**.

6: Perfecting Light Transmission and Absorption

To a team led by Stefan Rotter of Austria's Technical University of Vienna and Matthieu Davy of the University of Rennes in France for creating an anti-reflection structure that enables perfect transmission through complex media; along with a collaboration headed up by Rotter and Ori Katz from the Hebrew University of Jerusalem in Israel, for developing an "anti-laser" that enables any material to absorb all light from a wide range of angles.

In the first investigation, the researchers designed an anti-reflection layer that's mathematically optimized to match the way waves would reflect from the front surface of an object. Placing this structure in front of a randomly disordered medium completely eliminates reflections and makes the object translucent to all incoming light waves.

In the second study, the team developed a coherent perfect absorber, based around a set of mirrors and lenses, that traps incoming light inside a cavity. Due to precisely calculated interference effects, the incident beam interferes with the beam reflected back between the mirrors, so that the reflected beam is almost completely extinguished.

The more detailed for Perfecting light transmission and absorption is presented as: "Anti-reflection coating allows perfect light transmission" and "Anti-laser enables near-perfect light absorption"

Shaping the propagation of light in complex media:- The main obstacle for optical imaging or for sending information through turbid media such as paint, clouds and biological tissue is the random scattering of light. Owing to its immense complexity, the process of multiple scattering has long been described by the diffusion equation, which ignores the interference of scattered light. Recent developments in optical wavefront shaping and phase recording techniques have enabled the breaking of the diffusion limit and the control of coherent light transport in complex media, including strongly scattering tissues and multimode optical fibres with random mode mixing. Great advances have been made in focusing and controlling the transmission of light through such complex systems and in performing various tasks behind them, such as optical micro-manipulation. Here, we summarize the amazing power and the fundamental limits of controlling multiple light scattering, which lay the physical foundation to harness multiply-scattered light for imaging and communication purposes. Connections to practical applications are illustrated, in particular in those areas covered in the companion articles in this issue. Multiple scattering fundamentally complicates the task of sending light through turbid media, as many applications require. This Review summarizes the theoretical framework and experimental techniques to understand and control these processes **[8]**.

Fig. - 4: Non-Filtered and Anti-reflection Filtered Vision

7: Cubic Boron Arsenide is a Champion Semiconductor

To two independent teams, one led by Gang Chen at the Massachusetts Institute of Technology and Zhifeng Ren at the University of Houston in the US; and the other led by Xinfeng Liu of the National Center for Nanoscience and Technology in Beijing, China and Jiming Bao and Zhifeng Ren at the University of Houston, for showing that cubic boron arsenide is one of the best semiconductors known to science.

The two groups did experiments that revealed that small, pure regions of the material have a much higher thermal conductivity and hole mobility than semiconductors such as silicon, which forms the basis of modern electronics. Silicon's low hole mobility limits the speed at which silicon devices operate, while its low thermal conductivity causes electronic devices to overheat.

Researchers have found a material that can perform much better than silicon. The next step is finding practical and economic ways to make it. Silicon is one of the most abundant elements on Earth, and in its pure form the material has become the foundation of much of modern technology, from solar cells to computer chips. But silicon's properties as a semiconductor are far from ideal.

For one thing, although silicon lets electrons whizz through its structure easily, it is much less accommodating to "holes" — electrons' positively charged counterparts — and harnessing both is important for some kinds of chips. What's more, silicon is not very good at conducting heat, which is why overheating issues and expensive cooling systems are common in computers.

Now, a team of researchers at MIT, the University of Houston, and other institutions has carried out experiments showing that a material known as cubic boron arsenide overcomes both of these limitations. It provides high mobility to both electrons and holes, and has excellent thermal conductivity. It is, the researchers say, the best semiconductor material ever found, and maybe the best possible one.

So far, cubic boron arsenide has only been made and tested in small, lab-scale batches that are not uniform. The researchers had to use special methods originally developed by former MIT postdoc Bai Song to test small regions within the material. More work will be needed to determine whether cubic boron arsenide can be made in a practical, economical form, much less replace the ubiquitous silicon. But even in the near future, the material could find some uses where its unique properties would make a significant difference, the researchers say.

Cubic boron arsenide, in contrast, had long been predicted to outperform silicon on these measures, but researchers had struggled to create large enough single-crystal samples of the material to measure its properties. Now, however, both teams have now overcome this challenge, bringing the practical use of cubic boron arsenide one step closer.

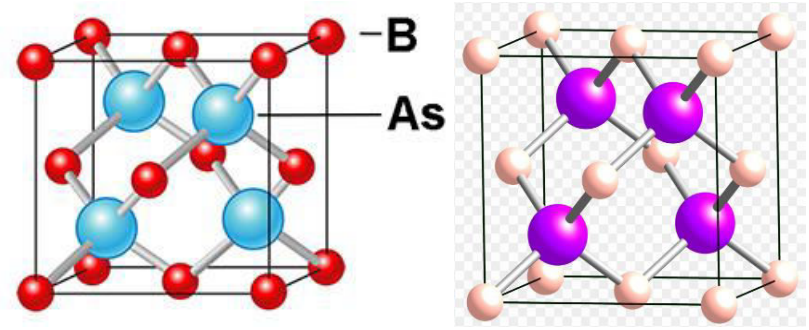

Fig. - 5: cubic boron arsenide

The more detailed for Cubic boron arsenide - a champion semiconductor is presented as “Champion semiconductor could replace silicon, say researchers”

Semiconductors with high thermal conductivity and electron-hole mobility are of great importance for electronic and photonic devices as well as for fundamental studies. Among the ultrahigh-thermal conductivity materials, cubic boron arsenide (c-BAs) is predicted to exhibit simultaneously high electron and hole mobilities of >1000 centimeters squared per volt per second. Using the optical transient grating technique, we experimentally measured thermal conductivity of 1200 watts per meter per kelvin and ambipolar mobility of 1600 centimeters squared per volt per second at the same locations on c-BAs samples at room temperature despite spatial

variations. Ab initio calculations show that lowering ionized and neutral impurity concentrations is key to achieving high mobility and high thermal conductivity, respectively. The high ambipolar mobilities combined with the ultrahigh thermal conductivity make c-BAs a promising candidate for next-generation electronics **[9]**.

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EVALUATION OF ANTICONVULSANT PROPERTY OF FLACOURTIA INDICA IN MES AND STN INDUCED SEIZURES IN RATS

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ABSTRACT

Purpose: *To evaluate the anticonvulsant and antioxidant properties of ethanolic extract of Flacourtia indica using two animal models maximal electroshock (MES), and strychnine nitrate (STN) for inducing seizures in rats.*

Methods: *In the entire two animal models MES, STN, each model were included 4 groups, in which albino rats (n=6) were used in each group. First group was considered as control, 2nd group as standard where Phenytoin 25mg/kg, diazepam 4 mg/kg is administered, 3rd and 4th served as test groups which were treated with ethanolic extract of Flacourtia indica (EETM) 200 and 400 mg/kg respectively. In all the three experimental animal models, all the groups were treated for 14 days. On the last day i.e., 14th day after completion of all drugs administration in all two animal models which is total 8 groups of rats, within 30-40 minutes seizures were induced by exposing them to a shock of 150 mA with convulsiometer using ear electrodes for 2 seconds in MES model, and 2 mg/kg of Strychnine (STN) model. Anticonvulsant activity was appreciated better only after abolition of hind limb tonic extension (HLTE) in Maximal electroshock (MES) model and by measuring the duration of seizures and latency induced seizure threshold in the STN experimental rat models.*

Results: *In MES model, EEFI at a dose of 400 mg/kg abolishes complete HLTE in the rats, similarly at the same dose observed prolonged latency in the onset of seizures in STN experimental animal models.*

Conclusion: *It is concluded that EEFI has shown effective anticonvulsant activity in these animal models as it abolishes HLTE in MES model and delayed the latency of seizure threshold in STN models.*

Keywords: Flacourtia indica, Anticonvulsant activity, Antioxidant, Maximal electroshock (MES), Strychnine (STN), and Diazepam.

INTRODUCTION

Epilepsy a group of disorders characterized by recurrent spontaneous seizures that apparently result from complex processes involving several neurotransmitters namely the glutamatergic, cholinergic, and gabaergic systems[1]**.**Alteration or changes exists in the nature of neuronal networks in the brain which causes seizures and also due to spontaneous expression of synchronized burst firing which interspersed by periods of normal electrical activity [2]. Glutamate and ɣ-amino butyric acid (GABA) are quantitatively the most important excitatory and inhibitory neurotransmitters respectively in the mammalian brain[3]. So these two neurotransmitters are reported as important targets for producing antiepileptic action. Approximately 30% of patients with partial epilepsy and 25% of patients with generalized epilepsy are not completely recovered with allopathic medications[4.] These many patients very of tenly take multiple medical treatments to control their seizures. Thus, there is an unmet need to identify newer molecules with antiepileptic properties. In our study we have chosen herbal medication and it could be one of the sources for newer antiepileptic therapeutics[5].

Flacourtiaindica(Burm.f.)Merr.SynonymoustoFlacourtiaramontchiL'Herit.(FamilyFlacourtiaceae)commonly known as 'Baichi' or 'Katai'. It is an indigenous medicinal plant widely distributed in Bangladesh and India [44].Chufa tubers are daily ingredients of the diet of many people in North Africa and Spain[6] . Several therapeutically important natural compounds have been isolated (such as alkaloids,

flavonoids, carbohydrates, tannins, saponins, and steroids) and they can serve as very potent and reliable drug candidate for treatment of various disorders.

This study was undertaken to evaluate the possible anticonvulsant activities of areal parts of *Flacourtia indica* extract using MES and STN induced seizure in rats.

EXPERIMENTAL PART

Plant Material

Areal parts of *Flacourtia indica* were collected during December 2018 from, Thirupathi hills, Andhra Pradesh, India. It was identified and authenticated by Prof.Dr. Madhavasetty, Department of Botany, University, Thirupathi, Andhra Pradesh, India. The voucher specimen was maintained in our laboratory for the future reference.

Preparation of Extract: Areal parts of *Flacourtia indica* was dried in shade, separated and made to dry powder. It was then passed through the 40 mesh sieve. A weighed quantity (500gm) of powder was subjected to continuous hot extraction in soxhlet apparatus using ethanol as solvent at a temperature range of 60-70˚C. The extract was evaporated under reduced pressure using rotary evaporator until all the solvent has been removed to give an extract sample.

Experimental Animals: Wistar Albino rats, weighing 150-170g, were procured from the animal house of CES College of pharmacy, Chinnatekur, Kurnool (Reg., no.1278/ac/09/CPCSEA). The animals were kept in polypropylene cages (6 in each cages) under standard laboratory condition (12 hr light and 12 hr dark day night cycle) and had free access to commercial pellet diet with water ad libitum. The temperature was maintained at 25 ± 10C with relative humidity (50 ±15%). The study was approved by the institutional animal ethical committee. Ethical norms were strictly followed during all experiments.

Acute oral Toxicity Study: The acute toxicity of ethanolic extract of *Flacourtia indica* was determined as per the OECD guideline no. 423 (Acute Toxic Class Method). The ethanolic extract of *Flacourtiaindicalinn*was observed to safe up to

2000mg/kg by oral route. After 24 hours animals were found to be well tolerated. There was no mortality and signs of toxicity. Hence 1/15th(100mg/kg),1/10th (200mg/kg) and 1/5th (400mg/kg) of this dose were selected for biological study(IAEC/CESCOP/AUG-2018-03)

Grouping of Animals:

In each individual animal model i.e; MES , STN having 4 groups, and each group had six rats. This grouping was common to all 2 animal models. Group I rats received sodium carboxy methyl cellulose (SCMC), Group II received Phenytoin / diazepam, Group III received EEFI 200 mg/kg and Group IV received EEFI 400 mg/kg. In Maximal electro shock seizure (MES) model, Animals exhibit hind limb tonic extension (HLTE) and the percentage of animals protected against HLTE were considered when it is abolished in 10sec and hind limb extension with plane of body.In Strychnine (STN) models**,** Latency of seizure threshold, duration of seizures, % of animals protected against seizures, % of animals protected against lethality were recorded within a thirty minutes duration[9] after intraperitoneal injection of (STN).

Induction of Seizures in rats:

1) Maximalelectroshockseizure (MES) Model:

Test was performed to induce seizures in Albino mice of either sex. Mice were subjected to shock of 150 mA by convulsiometer through ear electrodesfor2seconds on 14th day after 30 minutes of administering the last dose of vehicle, diazepam and extracts. The number of animals exhibiting hind limb tonic extension (HLTE) seizures and the percentage of animals protected against HLTE were recorded [7].

2) Strychnine (STN) Model:

Albino rats of either sex were used to induce seizures. On the last day i.e.,14thday,30 min after administration of the last dose of the vehicle, diazepam and the test extracts ,seizures were induced in rats in both models by intraperitoneal injection of Strychnine (STN)-induced seizure with the dose2.5mg/kg. The latency to STN-induced seizures threshold, the duration of seizures, percentage of animals

protected against seizures and percentage of animals protected against lethality were recorded within a thirty minutes duration[9] after intraperitoneal injection of (STN) [7].

Statistical Analysis:

Data were presented as percentage (%) protection and mean ±SEM and were analyzed by one-way ANOVA followed by Dunnett's test for multiple comparisons using Graph pad prism version 5.03.Resultswereconsideredsignificantat$p$<0.05.

RESULTS:

The percentage yield of ethanol extract of entire plant of *Flacourtiaindicalinn*was found to be 5.8 %w/w respectively.

Table: 1 Phytochemical Constituent

S.No	TEST	INFERENCE
1	Liebermann's test	Steroids absent
2	Salwoski test	Steroids absent
3	Schinoda test	Flavonoids present
4	Ferric chloride test	Tannins present
5	Dragandroff's test	Alkaloids absent
6	Brontanger's test	Anthraquinone absent
7	Kedde's test	Cardinolides absent
8	Legal's test	Cardinolides absent

Acutetoxicity Study

The results obtained indicated that *Flacourtia indica* extract at oral doses up to 2000 mg/kg did not produce any symptom of acute toxicity and none of the rats died during 72 h of observation and up to 14 days. Hence, 1/10th (200mg/kg) and 1/5th (400mg/kg) of this dose were selected for biological study.

DISCUSSION

The antiepileptic activity *Flacourtia indica* at two dose levels (200 and 400 mg/kg) was studiedby MES and STN induced seizure models.Antiepileptic drugs which abolish tonic extension occurred by MES acts by inhibiting spread of seizures. Drugs that either prevents or delay seizure occurrence caused by STN , act by elevating the seizure threshold[8]

In our study, in the maximal electro shock seizure (MES) test, 100% of the controlled rats exhibited hind limb tonic extensions (HLTE) seizure. The MES is a standard procedure which evaluates the ability of the testing materials to protect against HLTE. The seizure features in MES are similar for all laboratory animals and human except for the time scale[9] .The standard drug diazepam (4mg/kg) and the EECE (200and400mg/kg) exhibited significant anticonvulsant activity and provided protection against electroshock induced HLTE respectively. In the MES, protection against HLTE predicts the anticonvulsant activity of the tested compounds. More over protection against HLTE in MES- induced seizure indicates the efficiency of *Terminalia mollis extract* to either stop or to slowdown the discharge of the seizure within the brain stemsubstrate[10].Seizure induced by MES can be blocked either by inhibiting the voltage-dependent Na^+channels or by blocking glutamatergicexcitation mediated by the N-methyl-D-aspartate(NMDA)receptors[11]. Since *Terminalia mollis* extract showed anti-epileptic activity in the MES, itmayactbythe same mechanism of action[12]. Thesignificant anticonvulsantactivities *Terminalia mollis* extractmaybedueto thepresenceofmanypotent compounds or phytoconstituents such as flavonoids,phenols,and terpenes[13]

Strychnine is a neurotoxin which acts as an antagonist of glycogen and acetylcholine receptors. It primarily affects the motor nerve fibers in the spinal cord which control muscle contraction. An impulse is triggered at one end of a nerve cell by the binding of neurotransmitters to the receptors. In the presence of an inhibitory neurotransmitter, such as glycine, a greater quantity of excitatory neurotransmitters must bind to receptors before an action is potentially generated. Glycine acts

primarily as an agonist of the glycine receptor, which is a ligand-gated chloride channel in neurons located in the spinal cord and in the brain.

The protective effect of the whole plant of *Flacourtia indica* extract against STN-induced convulsions, proposes that it possesses anticonvulsant activity and that glycine neurotransmission is involved. Further phytochemical studies are required to isolate and identify the active molecule(s) responsible for anticonvulsant activity

CONCLUSION

In present study antiepileptic activity of ethanolic extract of *Flacourtia indica* against seizures induced by MES and STN were evaluated. The observed antioxidant and antiepileptic activities are due to the presence of considerable amount of flavonoids and phenolics in the ethanolic extract *Flacourtia indica*. Increased oxidative load is directly implicated as seizures can cause imbalance in oxidant, antioxidant system of brain which leads to oxidation of lipids, DNA and protein ultimately resulting into neurodegeneration. Ethanolic extract of *Flacourtia indica* 400mg/kg was showed good antiepileptic activity in MES as well as STN induced convulsions may be through MES can be blocked either by inhibiting the voltage-dependent Na+ channels or by blocking glutamatergic excitation mediated by the N-methyl-D-aspartate (NMDA) receptors and through glycine inhibitory property compared to 200mg/kg. Thus, results of our study showed promising antiepileptic and anti-oxidant effects of ethanolic extract of Flacourtia *indica* against both the toxicants and provided a scientific claim to the usefulness of this traditional plant in neurological disorders like epilepsy. However, further studies are needed to develop the exact underlying mechanism of antiepileptic action of possible constituents of the plant after isolation of bioactive compound.

Table No 2: EFFECT OF ETHANOLIC EXTRACT *Flacourtia indica (EEFI)* ON MES INDUCED CONVULSIONS IN RATS

Groups	Drug treatment	Tonic Flexion(sec)	Tonic Extensor(sec)	Clonic convulsions (sec)	Stupor(sec)
I	Control	12.17 ± 0.8724###	16.33±2.552###	13.50±2.487###	9.167 ±2.927###
II	Phenytoin 25mg/kg/I.P	2.833 ± 0.6009***	4.333 ± 0.8819***	4.000±0.8563***	3.167± 0.7032 ***
III	*EEFI*200 mg/kg/P.O	6.000±0.8563**	8.167±1.302**	7.000±1.390**	5.833±1.014 **
IV	*EEFI*400 mg/kg/P.O	3.500±0.7638***	5.000±0.9661***	5.167±0.9458**	4.000± 05774 ***

Where n=6 the observation are mean+SEM.*P<0.05,**P<0.01and ***P<0.001ascompared tocontrolAllthedatawereanalyzedbyusingonewayANOVAfollowedbyDunnett'stest. *EEFI*–Ethanolic extract of *Flacourtia indica.*

Table 3: EFFECTOF ETHANOLIC EXTRACT *Flacourtia indica (EEFI)* ON STN INDUCED CONVULSIONS IN RATS

Groups	Drug treatment	Latency(sec)	Onset of Jerky movements (sec)	Onset of Straub's tail (sec)	Onset of Clonic convulsions (sec)	No. of animals alive	%Inhibition
I	STN 2.5 mg/kg/I.P	35.17 ± 4.453###	55.33 ± 5.909###	28.00 ± 3.386###	44.67 ± 5.123###	2	33%
II	Diazepam 4mg/kg/I.P	103.0 ± 11.64***	121.3 ± 13.46***	91.00 ± 9.183***	109.2 ± 8.867***	6	100%
III	*EEFI* 200 mg/kg/P.O	84.17 ± 11.16**	97.83 ± 12.15**	70.17 ± 10.24**	80.83 ± 9.898**	4	66%
IV	*EEFI* 400 mg/kg/P.O	94.50 ± 11.51**	112.0 ± 13.43***	82.83 ± 9.119**	97.67 ± 8.815***	5	83%

Where n=6 the observation are mean+SEM.*P<0.05,**P<0.01and ***P<0.001ascompared tocontrolAllthedatawereanalyzedbyusingonewayANOVAfollowedbyDunnett'stest. *EEFI*–Ethanolic extract of *Flacourtia indica.*

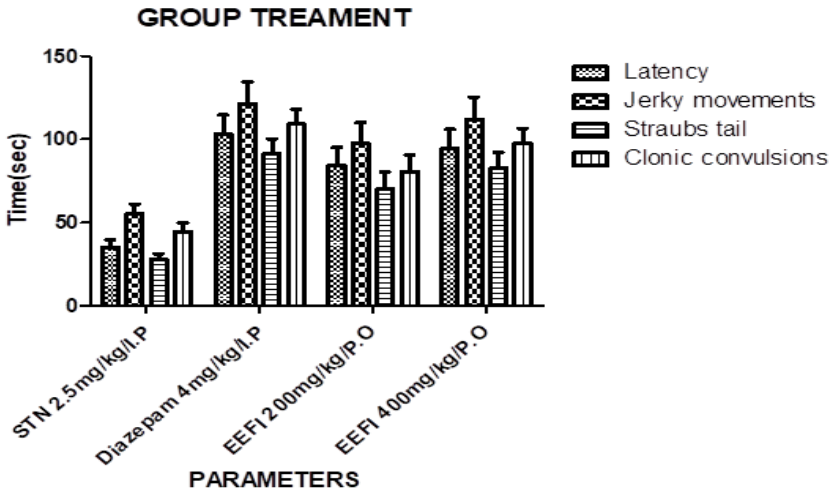
Table4: EFFECTOF ETHANOLIC EXTRACT *Flacourtia indica (EEFI)* ON STN INDUCED CONVULSIONS

Groups	Drugtreatment	Lipid peroxidation levels(nm)	Glutathione (nm)	Catalase (nm)	GABA (nm)
I	STN2.5mg/kg/I.P	0.485± 0.02130***	0.1821± 0.008531***	0.2890± 0.01768***	0.6763± 0.01768***
II	Diazepam 4mg/kg/I.P	0.2788 ± 0.01261***	0.4302 ± 0.0009455***	0.7594 ± 0.01498***	0.3722 ± 0.02098***
III	*EEFI* 200 mg/kg/P.O	0.3082 ± 0.01370**	0.3288 ± 0.01429**	0.5848 ± 0.01291**	0.4032 ± 0.01392**
IV	*EEFI*400 mg/kg/P.O	0.2558 ± 0.01197***	0.3792 ± 0.01726***	0.6954 ± 0.01788***	0.3457 ± 0.01654***

IN RATS -ANTIOXIDANT STUDIES

Where n=6 the observation are Mean+SEM.*P<0.05,**P<0.01and ***P<0.001ascompared tocontrolAllthedatawereanalyzedbyusingonewayANOVAfollowedbyDunnett'stest. *EEFI*–Ethanolic extract of *Flacourtia indica.*

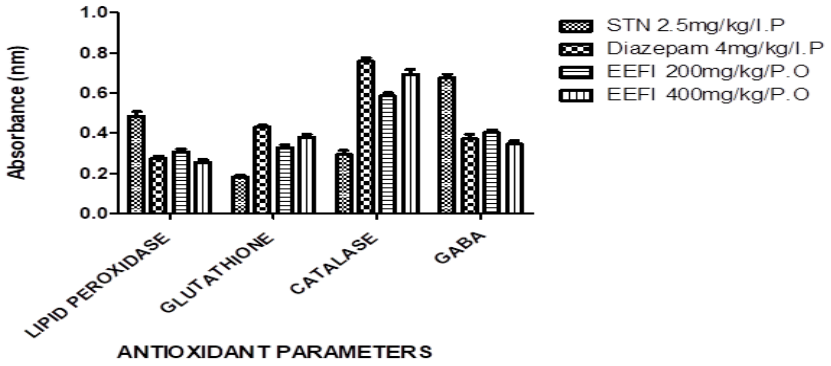
Figure 1: Effect of *EEFI* on Strychnine induced convulsions in rats



Where n=6 the observation are Mean + SEM. *P<0.05, **P<0.01 and ***P<0.001 in comparison to the control all of the data was evaluated with a one-way ANOVA and Dunnett's test.

***EEFI**:* Ethanolic extract of *Flacourtia indica*.

Figure 2: Effect of *EEFI* on Strychnine induced convulsions in rats antioxidants levels



Where n=6 the observation are Mean + SEM. *P<0.05, **P<0.01 and ***P<0.001 in comparison to the control all of the data was evaluated with a one-way ANOVA and Dunnett's test.

***EEFI**:* Ethanolic extract of *Flacourtia indica*.

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RFID TECHNOLOGY AND ITS ROLE IN LIBRARIES

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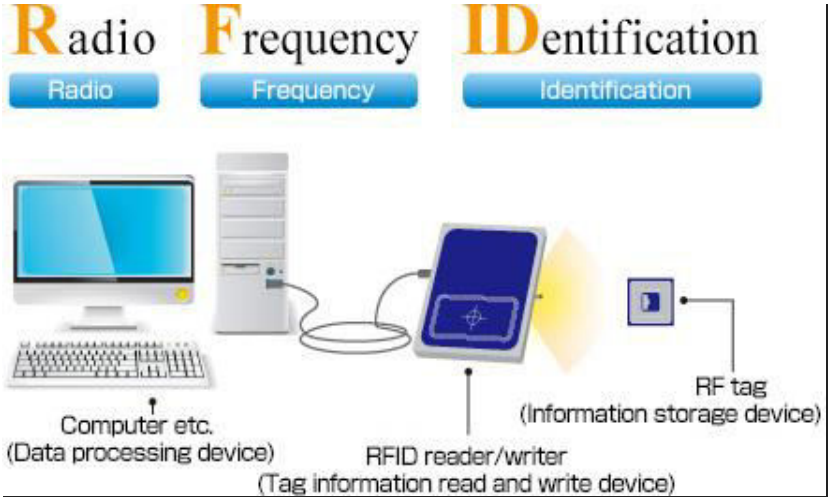
INTRODUCTION

RFID stands for Radio Frequency Identification. It is general term for a technology which uses radio waves to automatically identify an object or person. Radio Frequency Identification (RFID) is a form of wireless communication that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object, animal or person. It is a wireless technology used to transmit information from tags attached to object in order to automatically identify and track them. It is a broad category of automatic identification technologies, which includes RFID, Barcoding, Optical Character Reader, Biometric etc. RFID is designed to enable machine called readers to capture data on tags and transmit it to a computer system without the need for a person to be involved. RFID is a Dedicated Short Range Communication (DSRC) technology. RFID is similar to barcode identification system with a difference that it does not rely on the line of sight reading while barcode scanning requires it. In RFID the electromagnetic or electrostatic coupling in the radio frequency part of the electromagnetic spectrum is used to transmit signals**.** RFID s a combination of radio frequency-based technology and microchip technology is being hailed as one of the most important application in every field including highway toll payments, automotive, packaging and handling and retail industries, libraries etc. RFID has advantages over barcodes, such as the ability to hold more data, the ability to change the stored data as processing occurs, it does not require line –of –sight to transfer data and is very effective in harsh environments where barcode labels may not work. RFID, thus is a generic term for technologies that use radio waves to automatically identify people or objects. RFID technology at libraries located near the central campus and as a consequence, self service facilities are now available in

the majority of our family of libraries. This technology has enabled readers to borrow and return material whenever the buildings are open. Self-service facilities also allow for a much faster and more efficient way of borrowing and returning books. Not only does it mean less queuing to be served at the disk, but it also frees up library staff time from routine transaction so they can answer the queries and provide the front line help where it is most needed. RFID streamline work flow in the area of self service, book return shelf management and inventory.



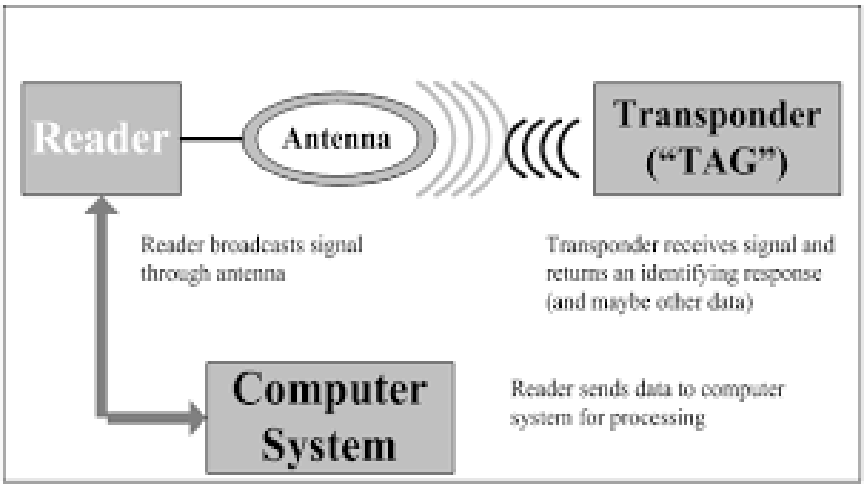
(***Source****:* http://technorsolutions.com/product.aspx&psig)

Definition of RFID:

According to the Harrod's Librarian's Glossary and Reference Book, " RFID is an alternative to Barcode that uses tiny microchip in tags to hold and transmit detailed data about the tagged item".

Dictionary of Library and Information Science defines " RFID as the use of microchips to tag library materials and library card, enabling users to check out items by walking through a self service station equipped with an antenna that emits low frequency radio waves".

According to Automatic Identification and Data Capture (AIDC) " Radio Frequency Identification is a technology that uses radio waves to transfer data between a reader and an electronic tag which is attached to a particular object. Typical uses are for object identification and tracking"



Source: http://article.sapub.org/10.5923.s.ijcem.201309.02.html&docid

Elements of RFID Technology: A RFID system consists of the following elements:

1) **RFID Tag**: An RFID tag is a tiny radio device that is also known as TRANSPONDER, smart tag, smart label, or radio barcode. This is very important element of RFID system. These are small low cost items which can be attached to items that need to be tracked.

There are two main components present in the RFID tag.

i) Firstly a small silicon chip or integrated circuit which contains a unique identification number (ID).

ii) Secondly, an antenna that sends and receives radio waves. The antenna consists of a flat, metallic conductive coil and the chip which is less than half a millimeter.

RFID tags are small plastic elements, which take a variety of forms. RFID tagging can also be accomplished in a variety of ways. Tags are the electronic chips consisting of an integrated circuit and antenna coil that communicates with a reader by means of Radio Frequency signals. After sticking RFID label on the book, its vital bibliographical data including accession number is registered in the chip of the label. RFID Tags are of following two types:

i) **Active:** These tags have a power source and have longer range. The practical range is of tens of meters and a battery life of several years.

ii) **Passive:** most commonly used tags, which do not contain any power. These tags consists of an integrated circuit and an antenna combined to form a transpoder. The tags collect the operating energy to form a Radio Frequency (RF) field emitted by a reader device therefore they do not need a battery and can be laminated between paper and plastic. The so called RFID Tags are all passive.

2) **Readers and Antenna:** The second components in a basic RFID system is the interrogator or reader. It is also known as receivers. It is an electronic device used to communicate with RFID tags. A reader has one or more antenna, which transmit radio waves and receive signals from the tag. It can be either fixed or mobile. When installed a library gates, they detect and read tags to obtain information stored there on. The reader powers an antenna to generate a radio Frequency (RF) field. When tag passes through this RF field, the information stored on the chip in the tag is decoded by the reader and sent to server.

Technically, reader units are transceivers(i.e; a combination of transmitter and receiver) and their usual role is to query a tag and receive data from it. RFID reader converts radio waves from RFID tags into a form that can be passed to middleware software. An RFID tag reader use antennas to communicate with the RFID chip. It can read information stored in the RFID tag and also update RFID tag with the new information. Hence, RFID reader accomplishes two tasks:

i) It receives commands from the application software and

ii) Communicate with tags.

An antenna produces radio signals to activate the tags and read/ write data on it. These are the channels between the tags and the reader. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually.

3) **Middleware:** Both middleware and software applications are required in an RFID environment. Middleware manages the flow of information between the readers and the backend. In addition to extracting data from the RFID tags and

managing data flow to the backend, middleware perform functions such as basic filtering and reader integration and control. RFID middleware assist with retrieving data from readers, filtering data feeds to application software, generating inventory movement notification, monitoring tag and reader network performance, capturing history and analyzing tag read events for application tuning and optimization.

4) **Server:** It is the heart of comprehensive RFID system. Various components of RFID system communicates through this gateway. Information received from various readers is exchanged with the circulation database. A server may be configured with an RFID system. It is a communication gateway among the various components. It receives information from one or more readers and checks the information against its own database or exchange information with the circulation database of the library integrated management system. The server typically includes a transaction database so that the reports can be produced. It is a link between reader and library automation system.

Role of RFID Technology in Library:

RFID plays a vital role in redefining the library process to make everyone's job easier right from user to library staff. Apart from security, it works as a tracking system. It combines security with more efficient tracking of books in the library. Following applications help libraries to increase efficiency and reduce cost.

1) **Staff Work Station**: Staff work station is staff assisted station which is used in a library for charging and discharging documents, programming of new documents, sorting of documents, etc. It consists of a PC. For doing programming/tagging of anew library document with the help of staff work station, it is first put on the reader, the accession number of the document is read with the help of barcode scanner and then the data is downloaded from the library management system. It enable staff to quickly and efficiently process the check-out and check-in of books/library collection. Stack of RFID tagged items placed over a station is immediately identified and processed in a single operation.

2) **Self Check-Out Station**: The Self Check- out station is a computer with a touch screen and a built-in RFID reader software for personal identification, document handling and circulation. Considering the high lavels of circulation per day, the staff is always over burdened with the issue and return of books. With the use of self-check-out system, the patrons can checkout the documents themselves by following the touch screen menu without taking any assistance from library staff.

It is very easy to self check books through RFID as it simply to be moved within range of RFID reader. It saves money as it reduces the labour cost of circulation activities.

3) **Automated Sorting Station**: Automated sorting station take books from the return station checks them in, sorts and distributes the books to multiple bins or areas for re shelving. Books are re-shelved by determining their shelving location in less time with less staff work. Libraries with large circulation eliminates the check-in and sorting of returned library documents by combining a sorter with one or more book drop readers. The sorters include conveyers to move materials from the book return to the sorter.

The sorting unit in combination with check-in station provides effective way to automatically sort the items. It is fully automation integrated conveyor system to sort checked in items into designated bins.

4) **Server Gates**: These are two or more theft detection pedestals, independent of each other, having overlapping protection zones providing additional security. Any unchecked item passing through these gates gets detected. Security gate/Electronic Article Surveillance (EAS) is an anti-theft system used by libraries. It plays a crucial role in detecting unborrowed or improperly checked-out library document. Theft detection is an integral feature of the chip within the RFID tag which performs both the item identification and antitheft function.

5) **Shelf Management System (Inventory Control)**: It streamlines the shelf management and makes locating and ordering items on the shelf, an easy and fast

task for the library staff. Inventory and shelf reading can be carried out with a portable reader. The reader transmits identification number to the server, which in turn sends it to library management software and response is returned in real time. Alternatively, information may be downloaded with library management software for inventory control. Shelf management system makes it easier for the library staff to locate and identify the documents on the shelves.

6) **Tag Programming Station:** A programming station that is used to link the programmable code on the tag affixed to a volume to the existing barcode used for identifying it. This operation is very small and easy to perform. It is used to programmed the new documents. Programming Station also to allow an efficient conversion of the collection from existing barcode to RFID tags. It enables to programmed the barcode data into the memory of the tag and to activate its antitheft function at the same time. Small in size and ergonomic, the programming station can be used in any library desktop configuration. The programming Station offers a simple connection to any computer. The Programming Station can be used in parallel with any barcode scanner.

7) **RFID Printer:** It is used to print labels with an individual barcode, library logo etc. Print command also programs the data on the chip. After this RFID label is pasted on the book.

8) **Book Drop Box Section:** It is very useful service for the user as the patron can return the book even when the library is closed. It is a machine with a slot with a chip RFID reader integrated into the wall. It is similar to the self checkout station. User puts the book in the slot and receives a receipt showing how many and which book(s) has been returned. It works with sorter and conveyor system. The book drop system consists of book drop with screen and receipt printer. It allow patrons to automatically return the library documents. A reader installed in a book drop allow reading of the RFID tags as patron drops off the documents. It eliminates the labour-intensive steps of check-in and deactivation of the security

protection by the library staff. It automatically checks-in the document, takes them off the patron's library account and reactivates the security function.

(***Source:*** https://www.google.com/url?sa+i& **www.researchgate.net%2 Ffigure%2FRFID-setup-in-the-library)**

How RFID System works in the Library:

RFID technology works through flexible, paper-thin RFID tags, which can be placed inside the cover of each and every document. Complete information about each document is entered into the library management software. Whenever a user brings a document for issue –return purpose, RFID reader from the tag reads the information pertaining to that book and transmits the data into the software and document is issued in a few seconds without the assistance of library staff. As the user takes the document outside the library, the antenna placed at the exit gate automatically reads the information contained on the RFID tag to variety whether the document is properly issued or not. In case, it is not issued to the user as per library norms or it is being stolen from the library, the antenna senses it and gives an instant alert. Thus, it results in successful theft reduction of documents. RFID technology is not only being used for circulation purpose in the libraries, it is also used for stock taking purpose.

Advantages of RFID Technology in Libraries:

Following are the main advantages of RFID technology:

i) Better Security

ii) Labour saving and quicker service means more staff available for assistance.

iii) Provides effective and efficient library detection system reduces chances of theft, and enhanced security of collection.

iv) High patron satisfaction level.

v) Efficient collection management system.

vi) Full autonomy to users. Self Check-in and Check-out possible, less staff interference.

vii) Reliability almost 100%.

viii) High speed inventory taking as it has ability to scan books on shelves without removing them.

ix) Automated sorting also reduces labour cost and saves time.

Issues Related to use of RFID Technology in Libraries:

Following are the main issues of RFID technology:

i) **Privacy**: As far as privacy is concern the potential threats of implementing RFID to patron privacy include unauthorized tags reading, writing, hotlisting, eavesdropping and tracking. Unauthorised tag reading occurs when the data between the reader and tag is unencrypted. This makes it easier for an unauthorized reader to read the data. Unauthorised tag writing occurs when an unauthorized reader inserts data onto the tag during the normal read-write process. The unthorised reader could illegally reset the security bit, allowing the user to walk out of the library with an unchecked- out book. Holisting is the process of illegally capturing data from the tag and matching it with specifically targeted item. Tracking is the process of using the tag located in the book to keep track of the movements of an individual. In order for tracking to be effective, the individual being tracked must carry the tagged books and there must be unauthorized readers wherever the person travels.

Cost: While there are many benefits of RFID, the cost of the same is very high. The cost is an important reason so that the libraries are not adopting this technology.

ii) **Vulnerability to compromise**: It is possible to compromise an RFID system by wrapping the protected material in two to three layers of ordinary households foil to block the radio signals. It is also possible to compromise an RFID system by placing two items against one another so that one tag substantially overlays another thereby cancelling the signals.

iii) **Removal of exposed tags:** RFID tags cannot be concealed and are exposed for removal. It can insert the RFID tags in the spines of all except thin books. A library can also imprint the RFID tag with its logo and make them appear to be bookplates, or it can put a printed cover label over each tag.

iv)**Exit sensor problems**: While the short range readers used for circulation charge and discharge and inventorying may read the tags as much as 100 percent of the time, the performance of the exit sensors is more problematic. They must read tags at up to twice the distance of other readers. The performance of exit sensors is better when the antennae on the tags are larger or when the exit lanes are 36 to 42 inches wide.

v) Standards: There are no real agreed standard world-wide for RFID. Only set frequency bands and some guidelines are available with regards to RFID. Operational standards and regulations are different for each country.

CONCLUSION

RFID is the latest and fast growing technology. It can be used in the libraries for minimizing the theft of books and documents. It is more than a security system. It is tracking system for the libraries which help in fast and easy discharging of services to its patrons. Librarians are always known as early adopters of technology and they have started using RFID to provide more effective and efficient circulation services as well as for security of library collections. The use of RFID technology by libraries over last few years has grown dramatically. The major barriers of RFID technology

adoption by more libraries is its cost factor, non availability of standards and user privacy. Earlier very few libraries were using this technology due to financial constraints, lack of training, shortage of staff. Initial activation problems. RFID technology mostly provides self service to user. Now days, it is being used in many university libraries, IITs and IIMs.

It is a technology which is sparking interest in library professionals because of its advantages and benefits which can be accrued if implemented. Its application increases efficiency, productivity, less human error, and improved speed of services. The future of Indian libraries depends on it and it is urgently require to make libraries RFID enabled.

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SPACE REVOLUTIONS OF 2022: EXPLORE THIS YEAR'S BEST PHYSICS FOR SPACE RESEARCH

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The Advances of the Year for 2022, which span everything from quantum and medical physics to astronomy and condensed matter. Space Breakthroughs selected through hundreds of research updates published on the website this year across all fields of physics. In addition to having been selected, selections must meet the preferred criteria:

- Significant advance in knowledge or understanding
- Importance of work for scientific progress and/or development of real-world applications
- of general interest to Physics fraternity mostly from Asia.

Criterion based selected advances for 2022 are listed and discussed below in particular order.

1: Opening a new Window on the Universe

To NASA, the Canadian Space Agency and the European Space Agency for the deployment and first images from the James Webb Space Telescope (JWST).

Following years of delays and cost hikes, the $10bn JWST finally launched on 25 December 2021. For many space probes, launch is the most dangerous part of the mission, but the JWST also had to survive a series of hazardous deep-space unpacking manoeuvres, which involved unfolding its 6.5 m primary mirror as well as unfurling its tennis-court-sized sunshield.

Prior to launch, engineers identified 344 "single-point" failures that could have hampered the observatory's mission, or worse, make it unusable. Remarkably, no issues were encountered and following the commissioning of the JWST's science

instruments, the observatory soon began taking data and capturing spectacular images of the cosmos.

The first JWST picture was announced by US president Joe Biden at a special event at the White House and many dazzling images have since been released. The observatory is expected to operate well into the 2030s and is already on course to revolutionize astronomy.

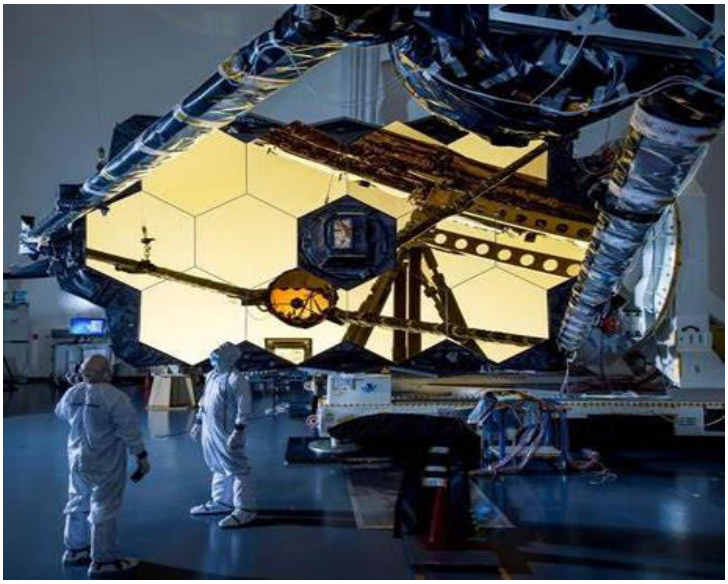

Fig.-1: James Webb Space Telescope

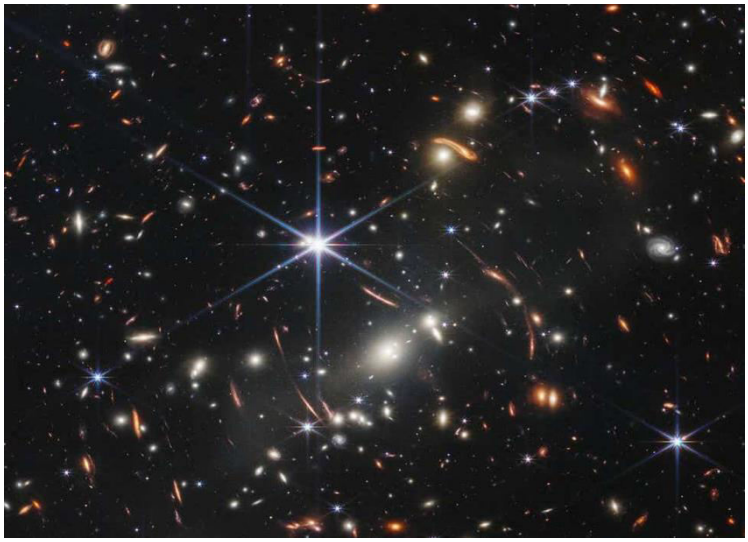

Fig.-2: James Webb Space Telescope reveals its first spectacular images of the cosmos

The more detailed for Opening a new window on the universe is presented as: "James Webb Space Telescope reveals its first spectacular images of the cosmos" **[1]**.

2: First-in-human FLASH Proton therapy

To Emily Daugherty from the University of Cincinnati in the US and collaborators working on the FAST-01 trial for performing the first clinical trial of FLASH radiotherapy and the first-in-human use of FLASH proton therapy.

FLASH radiotherapy is an emerging treatment technique in which radiation is delivered at ultrahigh dose rates, an approach that is thought to spare healthy tissue while still effectively killing cancer cells. Using protons to deliver the ultrahigh-dose-rate radiation will allow treatment of tumours located deep inside the body.

The trial included 10 patients with painful bone metastases in their arms and legs, who received a single proton treatment delivered at 40 Gy/s or greater – some 1000 times the dose rate of conventional photon radiotherapy. The team demonstrated the feasibility of the clinical workflow and showed that FLASH proton therapy was as effective as conventional radiotherapy for pain relief, without causing unexpected side effects.

The more detailed is presented as: "First trial in humans reveals promise of FLASH proton therapy"

Proton FLASH Radiotherapy for the Treatment of Symptomatic Bone Metastases: The FAST-01 Nonrandomized Trial:- Importance: To our knowledge, there have been no clinical trials of ultra-high-dose-rate radiotherapy delivered at more than 40 Gy/sec, known as FLASH therapy, nor first-in-human use of proton FLASH.

Objectives: To assess the clinical workflow feasibility and treatment-related toxic effects of FLASH and pain relief at the treatment sites.

Design, setting, and participants: In the FAST-01 nonrandomized trial, participants treated at Cincinnati Children's/UC Health Proton Therapy Center underwent palliative FLASH radiotherapy to extremity bone metastases. Patients 18 years and

older with 1 to 3 painful extremity bone metastases and life expectancies of 2 months or more were eligible. Patients were excluded if they had foot, hand, and wrist metastases; metastases locally treated in the 2 weeks prior; metal implants in the treatment field; known enhanced tissue radiosensitivity; and implanted devices at risk of malfunction with radiotherapy. One of 11 patients who consented was excluded based on eligibility. The end points were evaluated at 3 months posttreatment, and patients were followed up through death or loss to follow-up for toxic effects and pain assessments. Of the 10 included patients, 2 died after the 2-month follow-up but before the 3-month follow-up; 8 participants completed the 3-month evaluation. Data were collected from November 3, 2020, to January 28, 2022, and analyzed from January 28, 2022, to September 1, 2022.

Interventions: Bone metastases were treated on a FLASH-enabled (≥40 Gy/sec) proton radiotherapy system using a single-transmission proton beam. This is consistent with standard of care using the same prescription (8 Gy in a single fraction) but on a conventional-dose-rate (approximately 0.03 Gy/sec) photon radiotherapy system **[2]**.

3: Changing an Asteroid's Orbit

To NASA and the Johns Hopkins Applied Physics Laboratory in the US for the first demonstration of "kinetic impact" by successfully changing the orbit of an asteroid.

Launched in November 2021, the Double Asteroid Redirection Test (DART) craft was the first-ever mission to investigate kinetic impact of an asteroid. Its target was a binary near-Earth asteroid system consisting of a 160-metre-diameter body called Dimorphos that orbits a larger 780-metre-diameter asteroid called Didymos.

Following an 11-million-kilometre journey to the asteroid system, in October DART successfully impacted Dimorphos while travelling at about 6 km/s. Days later, NASA confirmed that DART had successfully altered the Dimorphos' orbit by 32 minutes – shortening the orbit from 11 hours and 55 minutes orbit to 11 hours and 23 minutes.

This change was some 25 times greater than the 73 seconds that NASA had defined as a minimum successful orbit period change. The results will also be used to assess how best to apply the kinetic impact technique for defending our planet.

The more detailed for Changing an asteroid's orbit is presented as: "DART mission successfully hits asteroid in first-of-its-kind test", and Close-up shows the last complete image of asteroid moonlet Dimorphos as taken by the DRACO imager on NASA's DART mission from about 12 kilometres from the asteroid and 2 seconds before impact. (Courtesy: NASA/Johns Hopkins APL) **[3]**.

Fig.-3: Close-up- The last complete image of asteroid moonlet Dimorphos as taken by the DRACO imager on NASA's DART mission from about 12 kilometres from the asteroid and 2 seconds before impact. (Courtesy: NASA/Johns Hopkins APL) **[3]**.

4: Detecting an Aharonov–Bohm Effect for Gravity

To Chris Overstreet, Peter Asenbaum, Mark Kasevich and colleagues at Stanford University in the US for detecting an Aharonov–Bohm effect for gravity.

First predicted in 1949, the original Aharonov–Bohm effect is a quantum phenomenon whereby the wave function of a charged particle is affected by an electric or magnetic potential even when the particle is in a region of zero electric and magnetic fields. Since the 1960s, the effect has been observed by splitting a beam of electrons and sending the two beams on either side of a region containing a completely shielded magnetic field. When the beams are recombined at a detector, the Aharonov–Bohm effect is revealed as an interference between the beams.

Now, the Stanford physicists have observed a gravitational version of the effect using ultracold atoms. The team split the atoms into two groups that were separated by about 25 cm, with one group interacting gravitationally with a large mass. When recombined, the atoms displayed an interference that is consistent with an Aharonov–Bohm effect for gravity. The effect could be used to determine Newton's gravitational constant to very high precision.

The more detailed for Detecting an Aharonov–Bohm effect for gravity is presented as: "Physicists detect an Aharonov–Bohm effect for gravity"

Laser system with Stark-shift-compensated dual beam splitters for observing a gravitational Aharonov-Bohm effect:- Light-pulse atom interferometers are excellent probes for studying gravitational interactions in quantum systems. The characteristics of the atom optics lasers are often essential in determining the performance of an atom interferometer. Here we have built a high-power laser system that enables Stark-shift-compensated dual beam splitters. Technical details of the laser system will be discussed. The second part will focus on the observation of a gravitational Aharonov-Bohm effect. When operating the interferometer with a source mass in a nonlocal regime, we identify the non-zero action-induced phase shift, deviating from that induced by deflections, as the gravitational Aharonov-Bohm phase shift **[4]**.

5: Membrane Mirrors Take Off for Use in Large Space Telescopes

Researchers devise new membrane mirrors for large space-based telescopes. Researchers have developed a new way to produce and shape large, high-quality mirrors that are much thinner than the primary mirrors previously used for telescopes deployed in space. The resulting mirrors are flexible enough to be rolled up and stored compactly inside a launch vehicle. "Launching and deploying space telescopes is a complicated and costly procedure," said Sebastian Rabien from Max Planck Institute for Extraterrestrial Physics in Germany. "This new approach—which is very different from typical mirror production and polishing procedures—could help solve weight and packaging issues for telescope mirrors, enabling much larger, and thus more sensitive, telescopes to be placed in orbit." "Although this work only demonstrated the feasibility of the methods, it lays the groundwork for larger packable mirror systems that are less expensive," said Rabien. "It could make lightweight mirrors that are 15 or 20 meters in diameter a reality, enabling space-based telescopes that are orders of magnitude more sensitive than ones currently deployed or being planned."

Adaptive parabolic membrane mirrors for large deployable space telescopes. A key element for the development of extremely large telescopes in space or balloon-borne observatories will be a reduction in the areal weight of the primary mirror. Large membrane mirrors offer a very low areal weight but are difficult to manufacture with the optical quality needed for astronomical telescopes. This paper demonstrates a practical method to overcome this limitation. In a test chamber we have successfully grown optical quality parabolic membrane mirrors on a rotating liquid in a test chamber. These polymer mirror prototypes of up to 30 cm in diameter show a sufficiently low surface roughness and can be coated with reflective layers. By manipulating the parabolic shape locally using radiative adaptive optics methods, it is shown that imperfections or changes in the shape can be corrected. With only tiny local temperature changes induced by the radiation, many micrometers of stroke have been achieved. Scaling the method investigated to produce mirrors with diameters of many meters is possible using available technology. This approach

opens the possibility to produce affordable extremely large primary mirrors for space telescopes. With the flexibility of the membrane material, this type of mirror can be compactly rolled up when stored in the launch vehicle, and then be deployed in space **[5]**. The thin and lightweight mirror created using this technique can easily be folded or rolled up for the trip to space. However, it would be nearly impossible to get it back to the perfect parabolic shape after unpacking. The researchers therefore developed an adaptive shape control based on a localized temperature change created with spatially variable light projection **[6]**.

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ROLE OF ICT IN TEACHING LEARNING PROCESS

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ABSTRACT

Teaching is a profession and teacher education is a process of professional preparation of teacher education must become more sensitive to the emerging demands from the school system. Teacher education is looked day after by a systematic operation of various agencies involved in it. Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and modern technologies are demanding teachers to learn how to use their technologies in their teaching. ICT (Information and Communication Technology) can provide more flexible and effective ways for professional development for teachers improve pre and in-service teacher training and connect teachers to the global teacher community. While ICT is not a panacea for all educational problems today's technologies are essential tools for teaching and learning. To use their tools effectively and efficiently, teachers need visions of the technologies potential, opportunities to apply them, training just in time support and time to experiment because only then teachers can be informed and confident in the new technologies. In this paper new possibilities and challenges that ICT has brought to teacher training and professional development has been discussed. It is concluded with discussion of emerging research issues with respect to ICT integration into teacher training and networking.

Keywords: *ICT, Computer, Internet, Teaching Learning System*

INTRODUCTION

Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and modern technologies and demanding teachers to learn how to use there technologies in then teaching. While new technologies increase teacher's training needs, they also offer part of solution. ICT can provide

more flexible and effective ways for professional development for teachers, improve teacher training and connect teaches to the global teacher community. Today's technologies are essential tools for teaching and learning. Research indicates that ICT can change the way teachers teach and that it is especially useful in supporting more student-centered approaches to instruction and is developing the higher order skills and promoting collaborative activities.

NEED OF ICT IN TEACHER TRAINING INSTITUTIONS

Knowledge of ICT and skills to use ICT in teaching/learning has gained enormous importance for today's teachers. Today's classroom teacher must be prepared to provide technology supported learning opportunities for their students. Teachers are expected to know successfully integrate ICT into his/her subject areas to make learning more meaningful.

To effectively harness the power of new information and technologies to improve learning the following essential conditions must be met :

- Students and teachers must have sufficient access to digital technologies and the internet in their classrooms, schools and teachers education institutions.
- High quality, meaningful and culturally responsive digital content must be available for teachers and learners.
- Teachers must have the knowledge and skills to use the new digital tools and resources to help all students achieve high academic standards.
- Teachers must have the knowledge and skills to use the new digital tools and resources to help all students achieve high academic standards.

Benefits of ICT in Teacher Education

- It envisages excitement to the learners' eyes, ears and more importantly the head.
- ICT fulfills the needs of learners by providing items and packages of higher standard and interest.

- ICT empowered simulated situation minimizes dangers in the real world.
- ICT is a powerful new development with ambitious roles in teacher education, digital and internet based multimedia transforms the present trend in the field.
- Unlike books it is interactive in native and creates motivation.
- Develops the ability of self-learning and interacting individually.

CONCLUSIONS

Today's prospective teachers will be expected to teach with technology in the classrooms of tomorrow. It is imperative that teachers become dissectors of then own learning with regard to using information technologies in the classroom. The teacher education system empowered by ICT can have a great opportunity to come up to the centre stage and ensure academic excellence, quality instruction and leadership in a knowledge based society.

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ABOUT THE BOOK

"**Evolutions Beyond: Pioneering Science and Technology for Tomorrow**" is a compilation of cutting-edge research and groundbreaking insights that propel the realms of science and technology into uncharted territories. This edited book takes readers on an exhilarating journey through a diverse range of topics, each contributing to our collective understanding of the evolving landscape of innovation. With a focus on pioneering advancements, this book explores the forefront of human achievement and its impact on various fields. For example, it describes the intricacies of the Forster/Fluorescence Resonance Energy Transfer technique, a method that revolutionizes our ability to study molecular interactions. In addition, it uncovers the most remarkable Physics research of the year, showcasing the latest breakthroughs and insights that have the potential to redefine the boundaries of our understanding and also exploring the discoveries that are shaping our understanding of the cosmos. In the medical field, it investigates the potential anticonvulsant properties of Flacourtia indica in controlling seizures induced by MES and STN in rats, shedding light on alternative methods for managing epilepsy. The role of Radio Frequency Identification (RFID) technology in transforming library systems and the application of Android-based learning has also been explored.

In this way, "Evolutions Beyond- Pioneering Science and Technology for Tomorrow" is an intellectual voyage that celebrates the innovative spirit of humanity and encourages readers to envision the boundless potential that lies ahead in the realms of science and technology. Hence, we hope this book will help readers to be updated with recent research and will gain knowledge in the process.

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