Achieving Novelty and Improvement in Education throughout the Implementation of Artificial Intelligence and Modern Sciences

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Abstract

The aim of the current research is to identify the applications of artificial intelligence that can be benefited from in developing the educational process and educational research. The research has adopted the descriptive analytical approach, by extrapolating and analyzing studies, research, books and periodicals that are related to its subject. To achieve the objectives of the research, an open questionnaire was designed. To find out the most important problems and challenges facing educational research and the role of artificial intelligence applications in facing these challenges, it was presented to a group of experts and specialists. The researchers concluded that there is a set of challenges related to the educational process - educational administration - teacher - learner - parents - student evaluation). In addition to the limited teachers' information and digital infrastructure in the educational environment, the lack of interest in training teachers and students on technological innovations, relying mainly on paper books, and the research presented many different applications of artificial intelligence and how to apply them in the development of education. The research also presented a group Among the recommendations, according to the findings of the results, the most important of which is the

adoption of some applications of artificial intelligence in the educational field, the dissemination of technological culture and information literacy, and the awareness of educational institutions and society about the positive aspects of artificial intelligence, and other recommendations.

Keywords: applications of artificial intelligence - modern science - educational field

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Introduction:

It has always been though that educational reform has to do with adding all the newly discovered knowledge to the current curricula. However, educational reform has more to do with the implementation of knowledge and educational technology throughout the consistent use of resources with the aim of achieving the objectives of scientific education, especially the objectives of teaching science and mathematics, where educational technology can be best implemented both in designing and application.

It is also widely known that educational technology is one of the modern trends in education, but, in fact, it is as old as education. The idea that educational technology is a modern trend is a restricted idea since it neglects the role of technology as a branch of education that depends on organized, integrated, and dynamic application of research findings into different educational contexts with the aim of improving the educational process quality along with learners' performance.

In light of the current technological revolution, which affects every aspect of the modern life, management experts in the world

agreed that knowledge, its implementation, and its continuous renewal are the most important means of institutional success, especially for educational institutions. This is because knowledge represents the most important strategic source of achieving excellence and creativity in an age where many intellectual concepts have been conceptualized; such as, globalization, information revolution, and the expansion of human societies.

Because of the importance of knowledge and technology in enhancing economy, the 21st century economy became knowledge-based economy, which depends on knowledge and technology as important dynamics for economic growth. It also makes use of highly qualified human resources as a pivotal asset for economic success. Knowledge-based economy depends on the following pillars:

1. **Innovation:** An effective system of economic linkages with academic institutions and other organizations. The role of these institutions and organizations is to cope with the growing body of knowledge in a way that makes it meet the local needs throughout using it to produce innovative new products and services in light of global environmental variables.
2. **Training and Education:** Human resources are among the crucial needs for economic productivity and competitiveness, especially in the knowledge-based economy and its advanced technologies. There are two major sources of human resources indicators: the data related to education and training, and the data related to competency or work.

It is worth mentioning that data-based indicators related to education and training allow for the assessment of human resources in terms of the required knowledge and the acquired skills. Moreover, it allows for the assessment of the stock of investment in human resources. This indicator is of high importance because of its direct impact on the technology and knowledge revolution in terms

of increasing the number of specialists in different fields of knowledge and, consequently, increasing productivity.

The previously stated facts put high demand on the different educational institutions to prepare learners (human resources), who are capable of implementing, managing, and investing knowledge. In order to be able to deal with future changes and challenges, learners should also be able to develop skills for the future throughout promoting autonomous and lifelong learning curricula and programs.

3. **Information and Communication Technology (ICT):**

Knowledge-based economics literature emphasizes the importance of ICT to knowledge, economy, and economic development. ICT does not generate knowledge; rather, it facilitates the dissemination and processing of information and knowledge in a way that helps the individual to adapt to local needs and support economic activity and motivate the establishment of value-laden projects.

4. **Economic Incentive and Institutional Regime**: Based on strong economic fundamentals, it can provide all legal and political frameworks that aim at increasing productivity and growth. These policies target making ICT more accessible, as well as increasing the competitiveness of enterprises.

In the light of previously listed pillars, educational institutions should strive to meet the basic requirements of the knowledge-based economy, which are:

- Improving the level and quality of education by equipping learners with the technological competencies.
- Gaining knowledge throughout modern and sophisticated methods and processes.
- Encouraging and supporting creativity as well as enhancing the skills needed for research and autonomous learning.

- Facilitating the accessibility to global knowledge sources and achieving the ultimate benefit from them.
- Focusing on managing knowledge and implementing its mechanisms and skills.
- Paying more attention to ICT and creating human resources that are more efficient.

The ability of a society to benefit from a knowledge-based economy depends, therefore, on how quickly it can become an educational economy through two major aspects. The first aspect has to do with learners' ability to produce and manage knowledge (wealth) based on their learning and participation in creativity. This ability is the primary drive for and main capital of economy. The second aspect has to do with the integration of sciences and their implementation into the production system in a way that turns knowledge into a productive force.

Since a knowledge-based economy requires highly qualified learners in both science and technology, who can advance and flourish society and maintain its competitiveness in world economy, education can be seen as the key to the age of knowledge, technology and community development since it works on the development of human resources. Therefore, a developmental shift in all the components of the educational system within the context of the knowledge system including the production, use, and transfer of knowledge may be the first and main step of a knowledge-based economy (Winkel & etal , 2015 ؛ Marti & etal , 2013).

The developmental shift in education requires great efforts both in education and training, as well as new methods of education and training, since ICT illiteracy has become a phenomenon that hinders progress ina an age where the rapid development of technology requires lifelong training. Saadi et al. (2012), emphasized on the importance of transforming the educational

system in a way that makes it able to focuses on providing learners with the skills needed for a knowledge-based economy; such as, lifelong research and learning skills, futuristic thinking skills, and other skills that increase learners' efficiency in adapting and keeping pace with rapid developments in information and communication technology.

In this regard, Barber (2009) introduced an equation that illustrates what it means to be a well-educated person: well educated = E (K+T+L). In this equation, E refers to the moral pillar or "ethics", K stands for "knowledge", T represents "thinking", and L is for "leadership" of oneself and others. With his equation, Barber has exceeded the traditional focus on critical knowledge and thinking to a broader range of leadership skills needed to turn abstract ideas into concrete actions and implement ethical underpinnings that can positively influence for society.

Thus, knowledge-based economy aims at promoting development, creativity, and imagination to find innovative solutions to current and future pressing problems. It also emphasizes on the need of high level education and training of individuals (human resources) and the development of accessing and applying knowledge all over the world. In light of the requirements of knowledge-based economy, it is necessary to reassess the teacher's preparation programs bearing in mind the information and technology revolution.

Developing in-service teachers' performance skills is a strategy for getting educational systems out of the current crisis, responding to knowledge revolution requirements, following up on the new knowledge in terms of its acquisition and optimal implementation of information flowing with it. Developing teachers' skills and performance include helping teachers carry out their roles as leaders and facilitators of learning. As UNESCO

reports, "Education is a hidden treasure" that can be revealed throughout achieving the four goals of education: (learning for knowledge, learning to employ ability, learning for adapting to others, and learning for being).

Research problem

And artificial intelligence can open new horizons in curricula, teaching strategies, and educational technologies for all fields of knowledge. So that it is used successfully in educational programs (Sarah Bint Thunayan, 2017,152.(

Despite the advantages of artificial intelligence that can benefit the educational process, the view of applying this type of education within educational institutions has varied between very optimistic ideas and negative ideas, which is why some users of these systems suffer from the lack of a proposal, mechanism or A model for combining artificial intelligence and education (Al-Atrebi, 8, 2019), but the focus of education is still more focused on remembering than developing creative and practical abilities.

Therefore, it was necessary to think about the best mechanisms and ways through which artificial intelligence applications and technological innovations can be employed in serving the educational process, developing it and achieving its goals, which is what the current research sought.

Based on the foregoing, the research raises the following main question:

What are the benefits of artificial intelligence applications in developing the educational field?

A group of sub-questions branch out from this main question.

- What are the characteristics and features of artificial intelligence, and what is its importance?
- What are the applications of artificial intelligence that can be employed in the educational process?

- How can artificial intelligence be employed in developing the educational field?

The Aims of Research:

The main objective of this research is to try to identify and study the applications of artificial intelligence as an input to the development of the educational process, by achieving the following objectives:

Define artificial intelligence in terms of its concept, characteristics, features and importance.

Know the most important applications of artificial intelligence in our lives.

Determine the applications of artificial intelligence that can be used to develop the educational field.

The importance of Research:

Curriculum planners and developers: This research draws the attention of those in charge of the educational process to the fact that artificial intelligence is a modern technology that has become an inevitable and effective tool to obtain greater efficiency in the educational process. , which contributes to the development of the educational process and benefit from the capabilities of students in the advancement of society.

Teachers: Enabling science teachers to use various artificial intelligence applications in the development of science education and learning.

Learners: It helps learners to employ their analytical, practical and creative abilities, which contributes to the development of the dimensions of the scientific sense and self-confidence, which will have a significant impact on their academic success.

Researchers: This research presents a practical model represented by presenting different teaching strategies and how to apply them in teaching and learning science, as well as the contribution of this research in its field and results in opening new horizons in the field

of scientific sense and its dimensions, in addition to developing self-confidence.

Research knowledge framework

In the age of knowledge-based economics, the educational and training programs offered to students in schools must include modern science and its technological applications. The following are examples of some modern science and its importance in the field of education:

1. Artificial Intelligence (AI):

A modern computer science that seeks sophisticated methods of programming to do similar tasks to those humans can do. AI is a science that seeks to define human intelligence and its dimensions, and then imitate some of its properties. It is not intended to compare the human mind God created with the machine that is man created; rather, it aims at understanding the complex mental processes that happen in the human mind during thinking and then translating these mental processes into the same programmed processes that can increases the computer's ability to solve complex problems.

The computer's AI can be defined as "the ability to represent computer models for a field of life and to determine the basic relationships between its components, and therefore to develop reactions that are appropriate to the events and situations in this field. AI, therefore, depends on making comparisons with the latest research and situations to reach useful conclusions.

The difference between AI and human intelligence is clear in the ability to generate a new model; while humans can generate and produce new models, AI is the representation of models that have already been produced by the human mind. Moreover, the types of conclusions that can be drawn from the model differ from a model are different; humans are able to use different

types of mental processes such as innovation, invention, and conclusion of types, whereas AI processes are restricted to limited conclusions based on established codes that were previously installed to the AI program.

Artificial intelligence focuses on the mechanization of human intelligence and the study of its mental capabilities. One of the most important reasons for studying artificial intelligence is understanding the processes that take place in the human mind, in a way that has nothing to do with philosophy, psychology, or anatomy. AI becomes a useful and effective science in many areas of our lives that have become digital, and although future is not predictable, it seems like computers with human intelligence will have a huge and visible impact on our daily lives and civilization.

AI can be considered a set of new methods in programming that can be used to develop systems that simulate some elements of human intelligence and allow them to make inferences about facts and laws that are represented in computer memory. There are many techniques based on artificial intelligence, including Smart Robot and Expert Systems.

AI is such a dazzling invention; how can this small head perform complicated processes like understanding, realization, prediction, and interaction with a bigger world. How can we start a path of research that aims at making and improving that small head? In fact, the science of AI is based on strong premises that the researcher would find possible to apply if he looked closer to the processes that AI depends on:

- **Education:** The acquisition of information and the rules to use this information.
- **Explanation:** The use of previous rules to reach approximate or final conclusions.

- **Auto-correction/Self-correction:** that needs the following points for application:
  - ✓ Data System: used to represent information and knowledge
  - ✓ Algorithms: We need them to draw how this information is used.
  - ✓ Programming language: used to represent both information and algorithms.

The objectives of AI:

AI aims at understanding the nature of human intelligence by implementing computer programs that simulate intelligent human behavior. It means that a computer program can solve a problem or make a decision in a given situation. The program itself can find the way that should be followed to solve the problem or to make a decision based on many evidentiary processes that the program has been fed with. This is an important turning point beyond what is known as information technology, where the evidentiary process is human-made.

The objectives of AI can be summarized as follows:

- ➢ Enabling machines to process information more closely to the human way of solving problems, i.e., parallel processing, where several commands are executed at the same time and this is closer to the human way of solving problems.
- ➢ A better understanding of the nature of human intelligence by uncovering the brain processes so that they can be simulated. As known, the nervous system, and the human brain are the most complex organs in the body and they work intertwined and constantly for recognition.

Different features of AI programs:

1- **Symbolic representation**: Symbolic representation is the first feature of AI programs and it uses non-numeric symbols. It is a clear contradiction to the prevailing idea that a computer can

only address numbers. Basically, a computer consists of dual codes, and these codes can take only one of two positions (1 and 0). The choice of these two digital codes has led to the widespread idea that a computer can only understand "yes or no" and cannot distinguish the shades of meaning between them.

But if we look at the same level of human beings as neurones, we find that human understanding also depends on the dual code in understanding situations, which indicates the possibility of expressing ideas, simple concepts, complicated concepts, and making decisions in sophisticated forms of these situations. The ability to express high and complex perceptions with dual codes understood by the computer makes it possible to simulate the process of decision-making in humans.

The computer can diagnose students' problems and provide justification for low marks.

- Example 1: A student suffers from short attention span at, overall mental weakness, and difficulties in learning mathematics, which led to low marks.

In this case, the computer can do a semantic process of digital information such as: The grade of a student in mathematics is 3 out of 10.

- Example 2: A student who has difficulty recognizing voices, understanding the meanings of words, and building on prior knowledge.

In this case, the computer can diagnose the student's problem through tracking his behaviors as in:

- deleting some words or letters from a given sentence such as the sentence: "you have traveled by plane" that the student may read (flying by plane).
- Flipping and switching characters.

- Some words are repeated more than once without any reason, for example, a student may read (the mother has clothed clothes).
- Add some words that aren't already there.

The previously mentioned examples clarify how unconventional methods have been adopted and artificial conditions have been created to help the brain receive information in unconventional ways through a speaking computer that helps in teaching children speech sounds faster. Those speaking computers slowly start to speak one voice at a time, until the student's ability to perform and hear sound in the context of words improves; the computer gradually becomes faster to reach the normal rate of speech.

- Example 3: A student who has writing difficulties inferred from some behaviors such as:
  - Reversing letters and numbers.
  - Mixing writing directions.
  - Ordering characters of words incorrectly.
  - In writing, confusing similar characters.
  - Deleting some characters from the word.
  - Adding unnecessary character(s) to the word.

Here the computer has contributed in developing student' writing skills, especially in spelling and organization. This has been done through enabling students to practice various and interesting writing activities using many computer programs, some of which depends on immediate auto-correction. Moreover, these programs also train students on some aspects related to writing organization such as leaving margins, line spacing, and spaces between words.

2- Heurisics: is the second feature of AI programs, which is related to the types of problems it tackles. Problems usually do not have a known algorithm solution, which means that there is no series of specific steps to follow to ensure a solution to the problem.

Therefore, programs that solve quadratic equations are not considered, for example, AI programs because they have a known algorithm solution.

3- **Knowledge representation:** AI programs differ from statistics programs in that they reflect a match between the outer world and the symbolic processes of the computer. This representation of knowledge can be easily understood because it usually does not use numeric symbols. A therapeutic diagnostic program may use the following rule:

This feature can be used in the field of education through the strategy of therapeutic teaching:

Therapeutic teaching is defined as "the set of educational efforts and procedures carried out by the teacher within the classroom to increase the achievement of those who have sensory, cognitive and psychological disabilities that hinder their ability to reach the expected level of achievement, and who are usually described as having learning difficulties". Increasing achievement may take place immediately within the teaching situation, or later when the teacher plans for a set of procedures for future improvement.

The term therapeutic teaching is used to indicate the types of educational programs for learning difficulties. Some of these programs implement individualised educational plan (IEP). This means that therapeutic teaching is an education that has its own objectives and educational content that takes into account the areas of strength and weakness of the student. It is also concerned with differentiated teaching that caters for individual differences.

The steps of therapeutic teaching can be summarized as follows:

1. Exploring the specific needs of the student, this is done through diagnostic assessment that reveals the student's interests and achievement level.

2. Setting short-term and long-term goals: these goals describe what a student should be able to do by the end of the school year.
3. Analyzing the task to be learned: any task to be learned must be broken down into its some subtasks. This analysis gives the teacher a deeper understanding of the steps the student should learn.
4. Customizing tasks to students' abilities: beginning with easy tasks first and then gradually complicating the tasks.
5. Modifying tasks to fit students' needs.
6. Choose appropriate rewards: the student is rewarded based on positive desirable responses.
7. Preparing the lesson in a way that keeps students from making mistakes.
8. Providing feedback: these can be presented in several ways to inform the learner that their responses are correct.

4- **Incomplete data:** The fourth characteristic of AI programs is their ability to reach problem-solving when decision is needed even if some of the required data for solving the problem is not available.

This feature has been used in the field of education throughout the Information gap Strategy, one of the collaborative learning and peer learning strategies, where two or more learners collaborate to provide collaborative feedback to exchange experiences and build on prior knowledge.

Steps of the strategy:

1. The teacher divides students into pairs or groups of four.
2. The teacher assigns an activity that can be accomplished by doing two complementary steps.
3. The task of each student is to work to achieve his or her activity. For groups of four, students work in pairs to carry out the activity.

4. After completing the activity, group members involve in a discussion on their answers, so that each student can receive and provide feedback within the group or the pair.
5. Answers are finally presented either orally or written before the whole class.

5- **Conflicting statements:** This characteristic of AI expresses its ability to deal with data that may contradict each other, and this is what we call contradictory data and we simply mean those data that are blunted.

This feature has been used in the field of education throughout the strategy of contradictory events:

This strategy is based on a cognitive challenge and motivation; the learners are introduced to educational events or concepts that conflict with their prior knowledge or experience. The strategy of conflicting data stimulates learners' active thinking and curiosity, which makes learning more meaningful.

The strategy of conflicting data depends on the existence of conflicting relationships between knowledge, this strategy is compatible with some aspects of Jean Biage's theory, especially the concepts of representation and harmony. Those two concepts are important when thinking about ways to increase student motivation for learning. When a student faces a situation similar to previous ones, he or she represents new information, which is later built in his cognitive structure.

This strategy can be used in different subjects:

❖ Example in Science:

- The learner knows the fact that solids turn into liquids by Heating.
  Contradictory event: Egg whites turn solid from warming.

- The learner knows the fact that when the wind blows, the curtains are pushed into the room

  Contradictory event: Some curtains are pushed out of the room.

- Objectives of using the conflicting data strategy:
  - ✓ Activating the left hemisphere of the brain
  - ✓ Generate, logical, and cognitive construction: the learner addresses conflicting situations as he observes the components of contradictory events and attempts to resolve the conflicts which increases the effectiveness of the left hemisphere of the brain, particularly in terms of creating a knowledge system about those contradictory situations.
  - ✓ Creating a positive attitude towards learning that leads to the development of learning styles.

- The steps of the conflicting data Strategy:

1. Introducing the contradictory event: in this stage the students' attention is drawn, and their motivation for study is increased. Students are also encouraged to question about the contradictory situation presented. This contradictory situation can be presented in a number of ways, including:

– The teacher introduces and explains the situation and then receives questions from students to teacher

– The situation is presented directly to students with the chance of discussing solutions in small groups.

The existence of contradictory events creates confusion and imbalances for students that bridge the gap between their past experience or prior knowledge and the new knowledge exemplified in the contradictory situations. This process makes them try to rebuild their knowledge structures so that they can be new to deal with the new event.

2. Search for a solution to the contradiction:

In this stage, the teacher can provide activities that help students resolve the conflict. At this point, teachers also will be passionate about finding a solution to the contradictory event.

In this step, learners acquire some science processes such as observation, data recording, experimentation, prediction, and classification. Learners can also learn many of the content and scientific concepts of the lesson.

3. Finding a solution to the contradiction:

At this stage, students succeed in resolving the conflict themselves as a result of their research or by their activities and experiences. Students themselves reach answers to many questions, which have been raised by contradiction. They also become curious about the solution, which stimulates their mind. This process is better than simply listening to the interpretation of some theoretical rules in the books.

To build contradictory-based lessons, the following steps need to be applied:

- Finding unusual events: In this step, unusual (contradictory) events are searched for to stimulate students' attention and motivation and encourage them to study to find ways to resolve the conflict by testing different solutions. Here learning starts where students become curious about the solutions for contradictory situations.
- Student involvement in conflict resolution: this step begins after the contradictory event is presented in a way that raises students' eagerness to find the answer. They become are more effective in observation, classification, prediction, experimentation, and any other mental processes that would help them reach their goal of resolving the contradiction.
- Solving the questions posed by the event or phenomenon: here students will solve the contradictory phenomena or events themselves after their active participation and research.

6- The ability to learn: one of the intelligent standards of behavior that improves performance throughout learning from previous

errors. There are many applications of artificial intelligence, the most common ones are:

- Game applications.
- Expert systems applications.
- Voice recognition applications.
- Machine-driven visibility applications.
- Shaping human performance.
- Planning and automation (like robotics).
- Artificial Intelligence languages and environments.
- Teaching machines.

Experienced System:

It can be defined as a problem-solving program that performs well in a specific field that requires specialized knowledge and skill similar to that of an experienced human. This system employs the knowledge humans and tries to simulate their thinking, skill, and motivation. Most expert systems can explain the causes of a particular conclusion. Unlike traditional programs, expert systems can employ quantitative and qualitative data, and even reach results from incomplete or uncertain data.

Expert systems and artificial intelligence are used in automated translation and in developing programs that achieve this goal while providing advice for solving problems.

Expert systems can imitate humans in their daily decisions; they can act like doctors, teachers, or economic planners. The expert systems succeeded in their technologies, which still depend mainly on the way information and experience are separated from the program.

The importance of this type of programs is represented in their ability to extract and store human experiences with a program, which imitates the expert in his work with the same level of quality. Thus, developing countries will pay attention to the necessity of

transferring these experiences through programs on small CD-ROM and not through costly human investment.

One application of artificial intelligence in teaching and learning is "game stimuli":

Game stimuli provide a rich learning environment for the application of constructivist theory in education. Constructivism is based on the idea of active learning, content delivery in the form of situations and problems, and meaningful real activities in a resource-rich environment, where learners are looking for information to achieve game stimuli. In these games, content is presented in levels in a stimulating environment.

Game stimuli also support the principles of the communicative theory that emphasize social learning, digital networking, computer and internet technology, and measure how knowledge is distributed across a network that includes learners and technologies.

The results of several studies in the field of education on game stimuli have indicated that they can improve learners' understanding, increase their motivation for learning, and attract their attention; e.g. (Ranathunga, et al, 2014), (Glover, 2013), (Harrold, 2015), (chen, et al, 2015), (MatsuMoto, 2016), (Menezes & de Bortolli, 2016).

Learning based on game stimuli has the following features:

- Designing educational activities and applications that include attractions, excitement, fun, and rewards included in electronic games and mobile apps for people with disabilities.
- Rewards in a game-stimuli environment are made publicly, since when a student is rewarded in front of his peers, his motivation for progress and achievement will increase.

- Increase the ability to retain information, and make it more likely to remain in the mind of a student who suffers from lack of attention and excessive activity.
- Increasing the satisfaction of student with short attention span and promoting activity towards the learning environment and positive attitude towards materials.
- It helps in developing self-efficacy and, thus, increase the efficiency and quality of the learner's performance.
- Provides collaboration, interaction, and competition among students during activities.
- Giving more freedom of committing mistakes during activities, and trying again to reach the correct answer.
- Provides learning through virtual personality (avatar).
- It enables the content to be divided into small parts in the form of levels that require a response from the learner to move from level to level. Thus, it provides immediate feedback, which prompts the learner to continue their learning, and this is consistent with the principles of behavioral theory.

A growing body of research; e.g, Glover (2013), Ranathunga, et al (2014),
Harrod (2015), World Government Summit and Oxford Analytica (2016), agreed that games share a range of elements that make them more motivating, and these qualities are:

- Dynamic elements (emotions).
- Mechanical elements (feedback – levels or tasks – badges – points – time)
- Self-contained items (winners – virtual personalities – collaboration and sharing).

Ranathunga,et al. (2014) mentioned examples of the use of game stimuli in education, as follows:

- (Language-learning site via translation): Duolingo is a free language learning site available to all countries of the world. It

offers interactive ways of learning six languages (French, German, English, Spanish, Portuguese, and Italian). In this site, each student can vote on the quality of the translation. The site also includes elements and motivations for earning points when completing lessons or successfully translating through the web.

- Poraora: A free 3D virtual world designed to make the learning process more fun for elementary students in cultural subjects, mathematics, geography, and problem solving.

- K-5 Math: Provides a means to help primary school students who are struggling with extra attention and excessive activity to gain concepts and skills needed to learn the subject.

- Class Dojo: where the class is converted to a game-like situation where rewards and immediate feedback are used, each student gets a symbolic image of positive behavior. Class Dojo also provides reports to help parents, all with a simple click on a mobile phone or computer.

- Class Edmodo: a free educational social network that provides teachers and students with a secure environment for communication, collaboration, sharing of educational materials with digital applications, as well as school assignments, grades, and discussions.

2- Robotics

"Robotics" is one of the most important sciences of the future that have witnessed remarkable development in recent years, thanks to the remarkable development in the rest of science and technology. The appearance of Big Data science has contributed to providing robotics with high efficiencies that were not accessible in the past. In addition, the invention of new types of sensors and the emergence of IoT that link different devices into a single network is capable of monitoring all surrounding environmental conditions and responding based on the

information they collect. All of these have led to the construction and use of a more complex generation of robots in all areas of life, such as industry, health, security, and human assistance. It is expected to be one of the most desirable disciplines in the labor market in the future.

The robot is known as a "multi-body mechanical system, with a number of Joints, which allows the required movement to be achieved for a body that is installed on the robot. It is also programed to perform a specific task in a mechanical manner.

Also robotics can be defined as a science that studies all aspects of the industry associated with engineering and building and operating robots. Robotics generally involves considering how a physical technological system performs a particular task to save time and effort.

There is a difference between the term Robot and the term Robotics. Robot is a machine that automatically moves upon human orders to carry out a particular task or set of tasks. Robotics, on the other hand, is the science of engineering, design, and making robots. This science includes three key areas: mechanics, electronics,
and programming.

Fundamentals of Robotics:

Despite the diversity of their types, shapes, and functions, robots share three basic components that must exist in any of them:

1. Mechanical construction: All types of robots have a structure or structure designed to match the task assigned to them.
2. Electrical element (power element): which operates and controls the robot.

3. The program element: All types of robots must have a type of programming that allows this robot to make a decision or perform a particular task.

Robot and instruction

Educational experts have been searching and reaching new strategies to help students receive all the information in the easiest way to improve and reach the best results. This led modern experts to develop educational robots that contribute to the educational process in ways and means that improve the academic level and performance and develop students' tthinking skills.

Recently, educational methods have been diversified throughout using robots. Variety of new means and methods have been applied in every aspect of the educational process including the school, the student, the materials, and the way the teacher opens, presents, and closes the lesson. Thus, in this era, robotics became the first complement to education. It has contributed to topics like mechanical features, unit conversion, ratios, proportionality, scientific progress, engineering design, balance of electronics principles, programming, etc.

Educational robots

Educational robots provide a learning environment in which students are involved and motivated to learn about robotic programming or learn the basics of programming in general by controlling and guiding these robots by programming them in simple ways. They also use educational robots for education, which helps encouraging innovation and creativity. It has been agreed that using robots can be an effective means of teaching science and mathematics in schools. Educational robots can take different forms, ranging from a simple computer to a robot with human parts and features.

The importance of educational robots

Educational robots achieve a range of educational objectives, including:

1. Promoting collaborative learning and team work: Designing and programming a robot requires more than one person to work together to implement the project. Working within a team encourages and nurtures social relationships among students. The shared responsibility of the team to accomplish the series of tasks to reach a final goal also contribute to the development of their leadership skills since each team has a different roles for members (group leader, programmer, designer, monitor, etc).

2. Encouraging and promoting the development of manual work skills: Robot science is a practical, applied science that focuses on the immediate application of education. The students need to use tools and pieces to design the robot body, which links theory to practice and builds students' knowledge in different fields.

3. Promoting project-based learning: The majority of student sessions in the robotics lab focus on the implementation of a specific project that they carry out together and, during this process, they learn many things and become aware of previously vague concepts and theories. In addition, they build experience and gain knowledge during the implementation of the project.

4. Developing and enhancing students' thinking and problem solving skills: Experiencing the practical project of making a robot, makes students use higher order thinking skills such as analysis, inference, evaluation, application, generating questions, generalizing ideas, effective expression, problem solving, critique, etc.

5. Emphasizing the integration of science: For making a robot, students need at least to benefit from the following sciences: physics, mathematics, electronics, and programming. This does not mean that students should be experts in these sciences; rather they only need the basic knowledge they get from their regular study of these sciences as school subjects. This does not negate the existence of some distinguished students who are more experienced in these sciences.

6. Promoting habits of mind and scientific research: Students' curiosity, enthusiasm, creativity, openness, precision, initiative, determination are promoted during the project of making the robot.
7. Training students on a range of important skills such as: time management, identifying resources, analyzing systems, project management and other skills that prepare students for career life.

8. Helping the teacher to apply student-centered learning: Making a robot requires the student to have a minimum of knowledge and a higher readiness for learning. Thus, robotics contributes significantly to training students to be independent learners. This is accomplished throughout involving them in projects and asking them to make a product by implementing their prior knowledge and the newly gained knowledge.

9. Connected learning to practical life: Most of the projects and applications presented at the robotics lab are real examples of the experiences students live in their daily. Examples of these real-life projects are: making cars, moving an automated man, automatic arm project, smart door project, the factory production line project, the robotic washing machine project, the robotic submarine project, the spacecraft project, as well as robotic sports projects; such as a robot playing football, basketball or table tennis. This makes the student learn more by understanding and applying the mechanism of the

machines and devices he uses every day, and connecting them to what he learns while in the robotics lab.

10. Enabling the teacher to use peer-teaching strategy: Students can design and teach a robot to perform certain tasks. By teaching and programming the robot, students learn, accordingly. Where the student is placed responsible for the output of this robot, the robot did the job properly, this means that the student understood the basis on which the application was built correctly. An example is: Students are required to design and program a robot that can paint so that the robot is required to draw a specific shape such as a square or a right triangle. In this example, the student will need to know what we mean by the square, its characteristics, how the angle and side are measured. If the robot is programmed, asked to draw a box, and the robot does this accurately, then the concept of the square and its main elements are clear to the student. This applies to language instruction, drawing, calculation, etc.

11. Making learning fun: Students are encouraged to learn and love science, especially as most the of students find no real pleasure in learning science and mathematics. But in the robotics lab, the situation is different since science and knowledge are combined with pleasure and excitement.

12. Training students to invent and innovate: This is one of the basic education requirements. All large industrial countries have made sure to introduce innovation and invention to their curricula, and the robotics laboratory helps to communicate concepts, inventions and innovation to students through practical projects that will drive them to innovate, try new results, and discover theories or invent modern devices or at least generate new ideas and discuss them with their colleagues.

13. Robotics can be used by more than one teacher: Robot science is characterized by the collection of a different science group. The teacher, whatever his major is, can use the contents of the handbook to communicate a scientific idea, theory, or concept. This helps the teacher enrich his or her scientific material with a variety of different applications, either in the lab or through the teacher's creative ideas. The lab also encourages collaboration among teachers so that more than one teacher can participate in one project, each according to his major, to produce a scientifically and technically integrated robot.

Given the importance and advantages of educational robots, can robots replace humans in education?

Although educational robots are important, they cannot replace the teacher to the teacher. But they can assist the teacher. The primary purpose of educational robots is to give students general skills and scientific concepts. And this makes robotics an effective means of teaching science and mathematics materials in schools.

It is worth mentioning that we do not teach robotics with the aim of making students specialists in this field; rather we do teach robotics to help learners understand the engineering design and the digital world they belong to. A mathematics teacher can use robotics to train students on decimals, fractions, numerators, and proportions. Also a science teacher can use robotics to clarify some scientific concepts; such as: stability, change, measurements, balance, and the relationship between form and function.

3. Geomatics:

Two of the newly discovered applications for learning are: Geoinformatics and geomatics. Geomatics is based on a number of sciences and techniques:

- Computer science representation of information through software programs.
- Geodetic science in determining the shape and size of Earth and mathematical models used in this representation.
- Area Science: It combines the equipment and techniques used to measure and represent the details of the features and terrain of the Earth's surface.
- Cartography: Cartography offers ways to represent natural and human models in paper or in digital form.
- Image area science: Locates targets through aerial images.
- Remote sensing: It obtains spatial and environmental information for remote ground purposes.
- Global Positioning System: It obtains the triangular coordinates of any place on Earth’s.
- Geographic Information Systems (GIS): Which allows for the storage, processing, analysis and presentation of a vast amount of spatial data.

Joseph Krksi (2013) has clarified the importance of GIS technology in education in terms of its benefit for students, teachers, and society. It also enhances 21st century skills, employment opportunities, and education based on problem-solving. It also allows for partnerships to occur through effective collaboration between students, faculty, community leaders, GIS practitioners, professional associations, educational institutions and others.

The effects of scientific and technological progress have been reflected in the methods of geographical research; the development mapping production system, remote sensing, and GPS has made use of various geographical data in several areas, which benefitted society various activities.

Global geographic standards have also emphasized the importance of using geo-spatial technologies to address the challenges of the

21st century that include: The Geographic Standards document "GFL2nd" from the American Geographic Society 2012, which emphasizes the use of geo-spatial technologies to identify and represent spatial data in a number of ways.

Scientific and educational importance of geomatic techniques:

Many studies have indicated the importance of geotechnology in the educational situation; e.g. Sharaf (2008), Hebron (2009), Duikat (2010), Abu Radi (2011):

- The integration of the theoretical and practical work of geographologists, which strengthens of the relationship between the geography and the integrated sciences.
- Representing a framework for the analysis of geographical data, both quantitatively and qualitatively. The ability to analyze the information is one of the unique functions of GIS in its.
- Displaying geographic information in a digital way that is represented in maps that can be read, analyzed, and interpreted by humans
- Geographical information systems (GIS) also reflect the entry of new technologies into the geographical field to cope with the science and technology development.
- 3D analysis in GIS can show multiple layers of 3D data.
- The ability to update spatial data helps in identifying the latest changes of that data, and performing its spatial analysis.
- The facility of drawing digital maps, distributing phenomenon on them, and updating and analysing the spatial and descriptive data.
- Producing automatic maps and overcoming the disadvantages of manual maps that have human errors.

- Establishing databases to be used in projects, commercial and educational environments. Example of the data bases is the database of the European Community for Environmental Protection, known as “continental experience” or “British experience”. Another example is Malaysia’s experience in building the infrastructure of an integrated geo-information system.

Bioinformatics:

Bioinformatics has been defined by the National Center of Bioinformatics Information (NCBI) as a field of science in which biology, computer science, and information technology are integrated together in a single scientific field. All the integrated sciences in bioinformatics help in analyzing and interpreting biological data at the molecular level and enhance the storage, regulation, and recovery of biological data. The science has a range of scientific applications scientific in several fields.

The bioinformatics community depends on two simultaneous processes: Increasing biological information, especially the type that results from the Human Genome Project (HGP). And increasing the information about the international project of the lithosphere and biosphere. The NCBI emphasizes that the ultimate goal of the field of "bioinformatics" is to enable the discovery of new biological visions and to create a global perspective through which the principles of biology are distinguished.

Nanotechnology

There is no doubt that our era is one of the scientific and technological breakthroughs. After the era of steam the Silicon era that emerged with the invention of the first transistor at the beginning of the 1950s, human civilization has entered a new era

since the beginning of the 1990's. It is an era of nanotechnology, nanotechnology, and the slogan of this technology was to make materials whose sizes are nanometer-based with surprising characteristics and tiny machines with incredible capabilities.

What is nanotechnology?

The origin of the word "nano" is derived from the Greek word "nanos", a word that means "tiny". Nanotechnology is a branch of natural science that is concerned with materials production by carefully controlling their molecules and atoms to produce substances of specific characteristics. This process is known as molecular manufacturing; for example, controlling the carbon atoms in coal in a way that leads to diamond production. Also, controlling sand atoms in a special body may produce computer slides. It is known that the traditional methods of making chemicals are based on mixing the components without taking into account the direction of the components, which produces a chemical that is different from its components. In nanosecond, on the other hand, the resulting materials are more accurate, precise, powerful, and resilient, because the methods used in this technology can guide and line up atoms and particles of material in selected positions and directions for intended characteristics of the final product.

What is nanotechnology?

There is a difference between nano-science and nano-technology the same way there is a difference between physics, electrical and electronic engineering, which are two applications of the basic principles of physics. It is also like the difference between chemistry, chemical engineering, and oil engineering, which are applications of the principles of chemistry. So there are two separate definitions for nano-science and nano-technology. Nano-science can be defined as a branch of natural science that studies the physical, mechanical, and chemical properties associated with reducing material volumes to nanometer in a dimension, two dimensions, or

all dimensions so that at least one dimension of matter is in the range 1–100 nanometers. Nano-technology, on the other hand is an advanced technology based on the understanding of nano-science and other basic sciences that it employs in producing unique new tools and particles that are measured in nanometer dimensions and used in different applications.

Principles that characterize nanotechnology

There are some principles of nanotechnology, which interest scientists and clarify why this technology is important. The most useful principles of nanotechnology are presented in the following table:

The principle	The benefit
The ability to move and rearrange individual atoms. .	The possibility of building any material in the universe because the atom is the unit of construction for all materials
The physical and chemical properties of matter at nano scale differ from properties of the same matter in normal size.	Discovering the characteristics of materials that are useful for many inventions and applications.
Nanotechnology is based on the principles of physics, chemistry, electrical and electronic engineering.	Integrating Sciences and encourages everyone with different scientific majors to collaborate with each other.
Nanotechnology can control atoms to make machines that are defect-free.	Material and machine properties become better. They are smaller, lighter, stronger, faster, cheaper, and less energy-intensive.
Nanotechnology relies on scientific research that can be applied to useful inventions.	Turning science fiction into scientific reality.

Applications of nanotechnology

In the field of medicine: Nanotechnology showed a very effective way of delivering medicine to the infected cell using complex polymers as drug-transmitters that target the infected cell. This application became a major reason for a significant improvement in the drug effect compared to previous ways of treatment. This has also led to a reduction in the toxicity of the drug and the reduction of its side effects, which benefitted cancer patients.

Another example is the use of nano-gold is a good opportunity to cure cancer and treat it easily without side effects. The Nano gold shells, which are delicate nanoparticles of gold, are injected with a thin layer of gold into the body and are collected in the tumor and then placed under infrared rays on the tumor area and pass safely through the sound tissues and warm the nano shells.

Nano Biotic is also the new alternative to antibiotics. The use of this technology will solve many antibiotic-resistant bacteria problems that have caused mutations that prevent the antibacterial effect on these bacteria. Nano biotic punches the bacterial cell wall or the cells infected with the virus, allowing water to enter the cells, which makes the virus fade away.

Nanotechnology can also assist in the process of remanufacturing or repairing damaged body tissues. Tissue engineering makes good use of the process of proliferating cells that are artificially raised by nanoparticle and growth factors. That technology may one day become a substitute for organ or organ trans mobility. Tissue engineering, however, raises controversial ethical arguments related to the use of stem cells.

Silver nanotechnology is a new medical invention; it eliminates more than 630 types of bacteria by smashing the walls of the bacterial cell, many fungi and viruses as well. The silver at this very

small size is decreasing in dimensions and increasing in the surface area, and the atoms of the silver element on the grains generate a tendency to migrate to the outer surface of the beads, which leads to a great increase in their chemical activity, as well as an increase in their interaction with the air oxygen. As a result, the toxic silver ions that are responsible for killing germs and viruses are formed and used to sterilize surgical instruments by painting silver particles on medical instruments are important, because of preventing the transmission of germs when performing operations.

This technology can be used in manufacturing electric and electronic machines and sets such as refrigerators with a thin layer of silver metal to kill bacteria and germs that may exist to protect preserved food from bacterial pollution. It can also be used to make shoes by placing silver metal nanoparticles inside the Shoe to prevent the growth of foot bacterial fungi during. This product is of great importance to diabetes patients who are permanently suffering from problems from wearing shoes for a long time that might result in inflammation and foot gangrene.

In agriculture: The so-called Agro-NanoTechnology, where nanotechnology is used to combat insect pests, monitor the location of insect infections within agricultural fields, reduce loss of agricultural crops and clear soil from heavy elements that hinder plant absorption of food and water. Nanotechnology also has the ability to increase agricultural productivity through genetic improvement of plants and animals, in addition to the delivery of genes and drug molecules to special places in plant and animal at the cellular level. It also helps to purify water from heavy material stuck in a way that is more than reversing the inversion and less costly.

In the field of industry:

- Packing Foods: Nano silicate particles of nano are used in packaging meat, vegetables, fruit, pastries, and fast food. These covers have good mechanical and functional properties that enable them to prevent the exchange of moisture and gases with the outside center which affects the distribution of colored materials, aroma materials, antioxidants, enzymes and anti-brown coloring materials. In addition, nanotechnology is applied to the creation of a special, anti-carbonated, and bacterial packaging.

- Makign food packing: Nano silver covers are used as an integral part of plastic to release some Nano chemical substances into the packaging. For example, anti-microbial, antioxidants, ingredients, and food support within food or beverages; for longer life, improved aroma, color, and nutritional value. Nano food packs have been developed in a way that can absorb any unwanted flavors or smells that arise within the food packs. Food packs containing carbon nanoparticles that could pump carbon dioxide or oxygen out of the cans if damaged were also produced.

- Discovering rotten food: Researchers believe that low-cost sensors on surfaces such as plastic film wrapped on food can be produced, so that rotten foods can be detected.

- Aircraft and car industry: The manufacture of space vehicles from nanoparticles is an important role in the progress of the industry, increasing its chances of success and increasing its safety. In addition, the amount of equipment and fuel consumption can be reduced, resulting in increased performance efficiency.

Based on the previously mentioned applications, nanotechnology is evident in the relationship between science, technology, and society. Rapid progress in nanotechnology and nanotechnology

research also requires more efforts by community institutions and educational institutions in particular to meet these developments

Preparing science and math teacher in light of Nano science trends:

It is importance to adopt the technological applications of Nano science due to their positive role in the teaching process, which is further explained as follows:

- Highlighting the functional role of nanotechnology concepts, which helps to gain and develop them among students
- Simplifying highly abstract concepts, especially those involved in mathematical relationships and theories which may facilitate their learning.
- Technological applications are rich area for demonstrating the interdependence and unity of concepts, which greatly helps in their teaching, as well as their active role in enriching science by highlighting the technological character of their content. This may be reflected in students' understanding of and direction of scientific concepts, and this integration enables students to behave properly in life situations, and provides a clear picture of community and environmental problems, to act upon them, to properly handle and maintain the devices.

When science and math teachers gain concepts and understanding of the ethical and social dimensions the field of Nano technology, they become able to convey these concepts throughout their teaching. Thus, what the teacher learns during his professional development programs, will teacher-preparation programs should be developed to suit modern Nano technology and science and too be able to equip teachers with the needed skills in this field.

Following are the reasons why science and math teacher preparation programs need to implement Nano technology:

- Mathematics and science teachers are specialized in a branch of traditional science, physics, chemistry, biology, or mathematics. Therefore, it will not be easy for them to teach topics about nanotechnology and science.
- Teachers need to develop awareness of the value of integration between different disciplines over a long period.
- Mathematics and science teachers are exposed to questions from their students about topics that may be significantly related to nanotechnology and science.

The knowledge dimension of nanotechnology and science has the primary role of modeling, imagination, and simulation. Because Nano science addresses atoms, molecules, and electrons that cannot be seen and represent nothing tangible in everyday life, learners can acquire concepts related to this field by using computer models and modeling, this will not clarify, visualize, and simplify ideas.

The theory of chaos

The theory of chaos is known as the theory of (squash), (turf), or (hyolic), one of the most recent physical mathematical theories that deal with dynamic, non-linear systems that exhibit a kind of random behavior known as anarchy, a behavior characterized by sensitivity to primary conditions. It is difficult to predict a consistent outcome at the end of the system's movement (gentle on, 2011, 32).

Carlo F. Barenghi (2010, p. 37) explains chaos: “It is the long-term non-cyclical behavior in the inevitability of a system that is based on the sensitivity of the first condition.” The theory of chaos is the study of non-linear systems that are sensitive to primary conditions and whose behavior or results cannot be predicted; In other words, there are simple things that may have a significant impact, that is, simple changes in the initial conditions in some systems can lead to significant variations in the output or behavior of the system,

resulting in unexpected results, making the forecasting process impossible or very difficult, due to the chaotic system.

The applications of the theory of chaos:

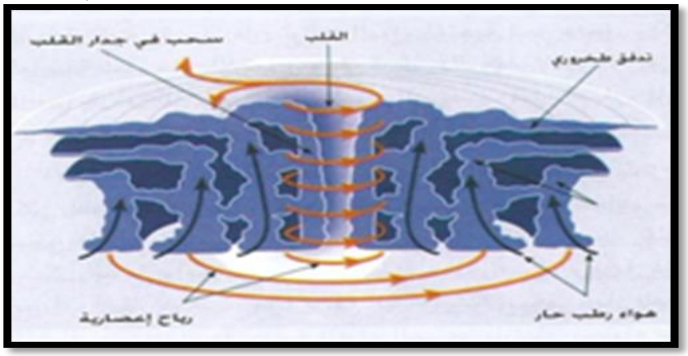
The theory of chaos has been widely applied recently in science and technology as chaos can be seen in weather, biology, economics, communications, and astronomy. The applications of the theory of chaos help explain the various non-linear phenomena of instability and stability that conventional mathematics could not explain, so the theory of chaos establishes other rules that do not yield results but that explain why the distant future of phenomena cannot be predicted (Wafaa, 2015; p. 344:345). The concepts of the theory of chaos have emerged in most areas of science, including:

Weather and climate change: Prior to the appearance of the theory of chaos, it was believed that climate prediction with Newton was accurate. Recently, the chaotic nature of the atmosphere over time has been shown to have a relationship with a range of engineering characteristics that evolve with the Earth's climate system, these findings indicate that the medium- and long-term weather forecasting process is impossible, i.e. the climate is sensitive to small changes in initial conditions (Arquímides Haro et al, 2015, p.445).

The meteorological centers always announce changes in weather every day, because they are unable to forecast weather conditions in the long run. Weather conditions cannot be expected three weeks from now, even if the globe is covered by information centers to monitor them using the most efficient computers. Climate modeling is radically different from weather forecasting, as current climate models cannot distinguish the inevitable future of weather. With any ideal combination of weather forecasts, there will be a trace of any initial uncertainty in the atmosphere so that it cannot be distinguished from similar climate distribution, and under incomplete models, this does not happen at all. The simulation

model set revolves around the model's attraction rather than the real point in the real world if it exists, so as our weather forecasting models are not perfectly accurate; their combined expectations do not develop toward realistic climate distributions. As the characteristics of the Earth's climate system change constantly, talk of "realistic climate distribution" is not constantly changing and unobservable.

Hurricanes in physics can help scientists to make predictions about their paths, intensity, and areas of their attractions, and shape () shows that there is a region in the middle of the hurricane's structure (swirl), which has an eye-like shape, called (the strange attraction of the hurricane), and the application of the chaos theory can produce some effects in the starting conditions that help steer the hurricane toward an area of attraction, which is far from human life, and, thereby, reducing hurricane's damage. But this depends on predicting the time of the hurricane; bearing in mind that hurricane cannot currently be predicted for more than three days (Ahmad al-Zidan, 2009, 15).



The shape () of the strange attractor of the hurricane

Biology

It studies the stages of life cycle of living creatures. They fight for survival, and it is very difficult to identify the causes and consequences of their actions, their behavior is almost chaotic,

the system's interaction with its environment is unpredictable, and the theory of chaos explains many natural phenomena in its applications that have found many areas of human activity. The application of this theory led to the interpretation of the behavior of systems in terms of unstable environment, and living creatures' transition from instability in a state of stability (Dinka Pančić, 2013.200-201).

Despite the complexity of the biological reality, its models are very simple. Biologists can deal with differential equations that look at time separately through the first generation, the second generation, and the third generation. Instead of differential equations that look at time continuously, they are therefore forced to use real numbers including fractions, roots, (Ahmad Al-Zidan, 2009, 12).

Living creatures' proliferation can be predicted throughout the logistic equation: $x_{(n+1)} = \lambda x_n(1 - x_n)$

The number of individuals in this generation (as an insect) is linked to its number in the next generation; it describes change in the number of individuals from year to year, where:

x_n represents the number of animals in this generation; the ratio between the number of animals in the "n" generation to the largest number that the generation can reach, is therefore confined between zero and one.

$x_{(n+1)}$ represents the number of animals in the following generation.

λ is fixed; it does not change by time (Dinka Pančić, 2013, 198).

The theory of chaos has solved a theoretical problem that has almost divided biologists into two groups: A group that sees the number of individuals of each species of organisms stable, and a team that considers these numbers to fluctuate irregularly and unpredictably. This theory showed a simple and specific mathematical model that

could express both views together, and in light of these findings, epidemiological statistics were re-read (Ahmad al-Zidan, 2009, 13).

Geology

It is difficult to predict changes in geological phenomena, especially in the long term. For example, if an earthquake has occurred, we will note that there is no specific period between the occurrence of the following earthquake. This cannot be predicted for the long term (Mahmoud Wafa, 2015, 343).

Economics

Economists believed that there was no relationship between short-term and long-term price changes, for they were merely minor daily imbalances that did not harm them, and that changes over months and years were governed by economic policy such as recession or financial crises.

In the last decades of the twentieth century, ideas from chaos spread in the literature of the economy, accompanied by expectations that many of the main problems in the economy can be easily solved using techniques inspired by chaos. Although many early predictions of chaos have not been met because studies in chaos have not yet been completed, and a model for the search for dominance in the economy has been developed, this model is based mainly on assumptions including:

- In the case of the absence of external shocks, the economy tends to be toward a decisive and fundamentally stable balance as its natural end.
- Economists usually favor linear models.

Linear models are the cause of a single solution or equilibrium without numerical procedures, and the idea that the nature of markets is unstable. This is only marginally changed with the emergence of chaos, because it stimulated the search for a mechanism by which perceived movements in real economic data are generated and the role of external shocks is reduced, as random

models explain these sudden fluctuations caused by external shocks in the system of chaos. These internal fluctuations are part of an inevitable process (Christos H. Skiadas and Charilaos Skiadas, 2016, 805).

The scientist, (Benoit Mandelbrot), found that price fluctuations do not depend on the short or long term changes; the daily price fluctuations curve is similar to the monthly price fluctuations, which is called the iterative curves, and to study the properties of their equilibrium it is necessary to know how to balance either achieve or approach (Blaž Krese Al et, 2014, 3).

Bradko company was founded on the assumption that there should be a better way to predict the state of the economic markets than the linear statistical methods that prevailed in the field of quantitative finance during the last two decades. This is where well-trained mathematical physicists are attracted to research problems of financial forecasting, which has traditionally been the exclusive domain of statisticians' work, and current evidence suggests that our best models of markets are essentially extortive, so the stock market is not chaotic but rather does not represent a linear model (Leonard Smith, 2016; 159-160).

In conclusion, the applications of chaos theory include a number of scientific fields such as weather, environment, physics, economics, astronomy, communication, politics, industry, medicine, etc. Some studies use this theory in an attempt to understand cardiac instability such as (AHmed Abou-Zeid, 2002). These experiments are expected to help determine the mechanism that leads to cardiac arrhythmia in the future, and doctors may need more early diagnosis devices, and better practical procedures than those used today. The complexity of these phenomena is due to the overlap of the results and the reasons (feedback), the system goes beyond the linear relationship between its inputs and outputs and follows a non-linear relationship, and if the rate of non-linear increases above a certain limit, it leads to the phenomenon of chaos.

Similarly, events in the classroom are not predicted, even if the teacher has carefully prepared the lesson, prepared himself with academic, conceptual, and psychological preparation, and used the best methods for managing the classroom. Because it is difficult to see a linear relationship between teaching and learning, student learning depends on other things that are also related to his or her life inside or outside school (Mr. Dadour, 2008, 569).

There is also overlap in phenomena that called for the theory of chaos; the study of chaos has contributed to spectacular developments at the confluence of weather and economics, as many markets are highly affected by weather, some of which are influenced by weather forecasts. For example, financial physics contributes significantly to the better distribution of rapidly damaged goods associated with their demand for weather, and the movement of ships. Trains, trucks, and forecast overall raise demand level (Leonard Smith, 2016, 160).

The importance of the theory of chaos:

– It explains the non-linear aspects of natural phenomena to the student-teacher.

– It helps the student-teacher to see nature as an open format some of whose elements depend on each other.

– It explains to the student-teacher the human body, where organs depend on each other.

– It clarifies to the student-teacher the idea that small changes at the beginning of a pattern lead to significant variations at the end of the pattern, because minor causes may cause major problems after a period of time. This requires looking at things objectively by not neglecting any simple effects.

– It helps the student-teacher understand the science of probability. By examining the theory of chaos, when a student-teacher knows that the theory of chaos has shown that accurate prediction in non-linear systems of the distant future is impossible. It will make it easier for him to learn the science of probability and to learn the reasons for his study.

– Enables the student-teacher to present concepts of chaos theory, within the math school curriculum, after graduation.
– Chaos theory benefits the student-teacher in knowing the relationship between mathematics and the computer, and its practical importance in mathematics.
– Chaos theory is also useful for providing interesting and useful material to the student-teacher, who may develop problem-solving and critical thinking.

Fuzzy Logic

The current era is characterized by scientific and technological development and knowledge revolution. Countries of the world try to exceed time in a race, where everyone seeks to catch up with the developed world and introduce scientific, technological, and cognitive advances in various fields. The sequence of technological advances in the current era depends heavily on the progress of mathematics.

In response to the changes of the age, the nature of advanced science and the union of the principle of uncertainty with the logical and physical ironies of reality, scientists were prompted to rethink science and mathematics, try to bypass the law of the third raised, and get out of the classic "truth/lie" duality. But those multivalued formats could not solve the problems that faced the dual logic. This gave rise to the metaphor of the application of the fazism groups to formulate different forms of approximate reasoning.

The fuzzy logic is a method of human thinking that allows for approximate values, inferences, vague or incomplete statements rather than relying on clear statements that involve a binary choice (yes/no). Hence, the objective of the fuzzy logic are:

1. Provide a framework for knowledge and reasoning in an uncertain environment.
2. Solve a problem called logical Paradoxes.

The fuzzy logic also attempts to model computer thinking according to the types of uncertainty and inaccuracies that exist in human

thinking. Through the logic of the metaphor, a system can express undefined concepts using words such as “fast, long, expensive, etc”. Moreover, they can be expressed using mathematical principles.

The fuzzy logic deals with ambiguity, uncertainty, and inaccuracy and gives freedom to the designers of control systems to understand the problems they face and to build smart control strategies. Non-linear control systems can be easily designed using the principles of fuzzy logic, making the fuzzy systems highly efficient when dealing with non-linear systems.

The discovery of Fuzzy Logic goes back to the Iranian scientist Lutfi Zadah. He first presented in 1965 a paper entitled Fuzzy Sets, where he discussed the concept of the fuzzy group as a group with no clear and specific limits, as it has provided the fuzzy logic to describe the more complex systems that cannot be defined and defined using specific mathematical analyzes. The main features of the fuzzy logic are the use of language variables instead of numerical variables and the expression of relationships between variables in the terms of a metaphor, and the increase in the applications of the metaphor in economics, administration and medicine.

This logic is characterized also by not relying on rationally crafted measures and by using it, we make endless, continuous, and honest responses and decisions that are not bilateral, but partial truthfulness that extends between [1 and 0]. Therefore, the fuzzy logic is "a logic that deals with vague non-numeric variables such as linguistic variables, as traits such as long, short, old ... Poor... These are vague, unambiguous, and relatively honest – partial – not necessarily 1 or zero. To 1, this relative honesty is called the degree or estimation of the affiliation of μ.

Some applications of the fuzzy logic:

At the beginning of the 1980s, Japanese companies realized the commercial potential of the fuzzy logic and began investing in it, the starting point was the invention of the first chips slide for fuzzy logic by researchers at the Bell Lab in 1978, which gave the possibility of coding and accomplishing a set of fuzzy rules within a chip. The production of smart products is cheaper and faster, using a small package. The fuzzy logic chip can perform 580,000 fuzzy reasoning per second.

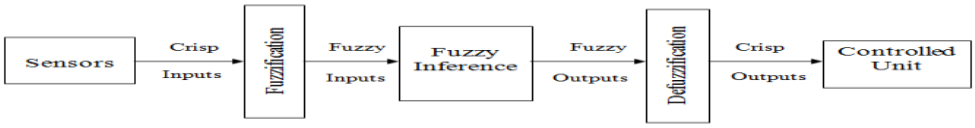
This invention led to a wide spread of fuzzy products, as Hitachi designed a gas-based automatic train that combines speed and safety, and Canon made the first video camera with an automatic focus using fuzzy logic. Matsushita made washing machines and smart machines as well. The applications of fuzzy logic in various areas of artificial intelligence such as expert systems, natural language processing, computer vision, automatic programming demonstrated commercial successes.

We can say that Fuzzy Logic Control System is the greatest success achieved in the application of the fuzzy systems in the industrial and commercial fields. Vast number of applications of the Fuzzy control systems has been made, including robot steering controls, flight guidance while flying. In addition, the fuzzy control systems were present in home machines including the rice cooker, which adjusts the temperature and cooking timing according to the rice type, the electrical washing machines, that are controlled by fuzzy control systems that adjust the water level, amount of detergent, length of wash cycle depending on the amount of clothes, the degree and type of heat, vacuum cleaners, and microwave ovens.

Fuzzy logic control system

The Fuzzy is defined as a control system in which inputs and outputs are fuzzy variables related to an “if-then” relationship in

which the rules of the fuzzy system are used to calculate the output values corresponding to given input values.



Fuzzy logic control system 6

at Queen Mary's College in London, at the beginning of the 1970s. When he and his colleagues were developing an automatic control system for the steam generator, and while they were writing the traditional rules of the system, they read a paper for the increased use of fuzzies and algorithms for analysis and decision-making in complex systems. As Mamdaani wrote: “How easy it was to design a knowledge-based combination of linguistic and mathematical variables”, and he actually succeeded in establishing the first fuzzy system, and then created a Fuzzy Traffic Lights.

Fuzzy control systems are suitable in the following cases:

- Complex systems that are difficult or impossible to model.
- Systems controlled by experts.
- Systems with complex and continuous input and outputs.
- Systems that use human observations as input or as a basis for rules.
- Vague systems such as those in behavioral sciences and the humanities.

Fuzzy Expert Systems

Expert systems are systems capable of solving problems and providing consultations in a given area the same way the human expert in this field does. An expert system consists of two basic parts:

- Knowledge Base including specialized knowledge in a particular field.
- Inference Engine; it consists of algorithms to process knowledge in a knowledge base.

As long as the knowledge base of any expert system is a repository of human knowledge and most human knowledge is inherently inaccurate, the usual case is that the knowledge base of any expert system contains a set of rules and facts that, for the most part, are not completely coherent, i.e., utterly inconsistent. Therefore, the issue of uncertainty management is of fundamental importance in the design of expert systems known as Fuzzy Expert System).

The medical field is considered one of the most important fields of the expert systems. This is becasue the fuzzy system provides a natural framework for dealing with uncertainty and inaccuracy in the diagnosis of the disease. Expert medical systems are able to handle patient inputs described using vague language boundaries and apply the complex language decision-making process of doctors.

Applications of fuzzy system in neural networks:

Applying the fuzzy logic in neural networks corrects errors and improves to optimization, pattern recognition, and decision making. Here the fuzzy logic is applied in human reasoning with the rules of knowledge systems in the Neural Network to produce neurological logic in which the resulting knowledge is an educational capability of learning power that simulates neurons of the human brain.

The neural network simply models the information processing of the human brain, the neuron consists of one or several layers of the nodes heads and the links of the patterns, classification, and other non-numeric problems. A network gets smart results through parallel calculations without using logical rules.

As in the human brain, the neurons receive signals, process them, and then send their treatment to several nodes heads. The network trains to identify a pattern of signal strengthening (by adjusting the weights of the brackets), improving the effectiveness of the desired results, and weakening incorrect or ineffective signals. Network remembers this pattern and uses it when processing new data. Most of these networks are in software.
Neural networks are used to produce phonic bases that are applied in control systems to improve and correct errors and make them more effective.
The neuronal systems have become practical uses in the control devices for the home appliances. The new German washing machine learns to use water according to the habit of its operation. The fuzzy systems control the actions of the machine and the neural network, improving them with the precision of fine-tunes to make them more effective.
In general, the meta-logic has a great role in developing different systems and improving their operation, especially the complex non-linear systems that are difficult in biological, medical, DNA, and economic fields.

The importance of artificial intelligence and modern science in the developing the educational programs in college of education:

The need to develop math and science teacher-preparation programs is illustrated in the following points:

- The need to develop genius minds through the study of modern science:

Since the new geniuses in information and communication technology choose the big problems that have wide applications in different remote areas as a result of their great sensitivity to the wide environment that includes the economic need in a civilized context, modern science in solving modern problems has produced many applications in vital, human, mechanical, scientific and

technological fields that contribute to the development of a renewable mentality.

- The need to develop transformational innovation through the study of modern science:

The revolutionary change of knowledge depends on innovative mindsets with transformational innovation capable of transforming the Paradigm shift system and these mindsets are reaping the course of science. Copernics and Galileo have changed the idea that the Sun is the center of the universe and not the earth, and that Earth is the one that revolves around the Sun, contrary to what was believed before. This modern science has also revolutionized science by dealing with non-numerical variables characterized by ambiguity, inaccuracy and uncertainty, such as human behavior mechanisms, biology, and languages.

- Developing levels of pedagogical innovation for the teacher by leveraging modern science learning in his preparation, which will brig about the following results:

- His students are encouraged to search for mathematical roots and historical connections to mathematical ideas and to be related to athletes.

- To make school knowledge more vibrant and closer to nature and life by linking it to nature, human body and space. That is, it makes them realistic about the rest of life.

- Make school knowledge more accessible to online inspection and other sources that are more about what they learn.

- Make school knowledge more modern by making connections to mathematical, artistic, or recreational topics with what students learned and enlighten students about modern mathematical innovations.

- The activation of creative thinking and tinnovative, artistic, and sporting aspects of his students, by highlighting the enjoyable aspects of knowledge in its components, and having fun with its ideas to feel its beauty.

Hence, the implementation of modern and innovative knowledge in science and mathematics is necessary to prepare a future teacher who can keep up with every new aspect of knowledge. And in order to be able to deal wisely with primary and secondary students while teaching these sciences, and reviewing their objectives. That is why teacher preparation programs need more attention to qualify teachers to respond to the developments in science and mathematics, and to deal with current and future problems.

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