The CCK Clerestory

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Editor's Note

Dear reader,
Welcome to the CCK Clerestory magazine.

Corridor of Comprehensive Knowledge (CCK) is a non-profit organization. It has been established with the goal of introducing various branches of STEM to elementary and high school students in a low-cost and creative manner, with or without using virtual technology.

In the CCK, experts design and create scenarios (workshops) which can be performed for a live audience (students) to convey scientific concepts to them. The workshops also include related hands-on activities, in which students would actively participate to enhance their learning experience.

In each workshop, the related curriculum content and connection to scientists or those who have used the concepts, historically or in modern technology, are also provided.

Similar to a clerestory window which allows light and fresh weather to come to a room, the CCK Clerestory magazine also brings the lights of knowledge to the Corridor of Comprehensive Knowledge. In fact, accepted and selected papers, short stories, comic strips, interviews, etc., all having scientific themes, coming from this particular clerestory window, make a fresh knowledge weather in the CCK.

Authors, who are interested in the CCK magazine, are invited to send us their papers in which, they propose a theoretical or practical method, making a complicated scientific concept becomes more understandable. They may also illustrate how a well-known rule, theorem or method has specific role in modern technology, science, math., art, sport, etc. The papers may also demonstrate the details of assembling the intended equipment or device which has been designed to improve the performance of education. And finally, they may propose innovative and proven methods and directions to improve teaching performance.

We hope you enjoy this pre issue of the magazine. Your submitted manuscripts and comments, undoubtedly, improve the performance of the magazine in its successive issues.

Sincerely,
Dr. Kamal Shahtalebi
Editor-in-Chief

Toreh, A System to Illustrate Data Transmission

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Abstract:

In this paper we propose Toreh, a simulator system which has been designed to illustrate the spread spectrum technique in data transmission. The method which was introduced by Hedy Lamarr, an Austrian-born American film actress and inventor who developed this technology in a radio guidance system for Allied torpedoes to defeat the threat of jamming by the Axis powers in the World War II.

1) Introduction:

This paper demonstrates a scenario which is a fun way for school age students to indirectly learn about a special method in data transmission. With the proposed scenario we also introduce Hedy Lamarr, an Austrian-born American film actress and inventor who developed a telecommunication system for Allied torpedoes that used spread spectrum and frequency hopping technology to defeat the threat of jamming by the Axis powers. As a woman, her undeniable role in World War II, helps to illustrate her idea in data transmission via a knockout competition game. The curriculum included in this document is suitable for a two-hour workshop with grade 6/7 participants. The curriculum can easily be modified for longer or shorter workshop and can be adapted for younger or older participants as well. It is to be notified that data transmission and computer knowledge is part of every curriculum in all countries. For example, the relevant curriculum items for the proposed scenario in British Columbia, Canada are:

Applied design, skills, and technologies 6-7 (Computer and communications devices)

https://curriculum.gov.bc.ca/curriculum/adst/6

https://curriculum.gov.bc.ca/curriculum/adst/7

Applied design, skills, and technologies 9-12 (Information and communications technologies)

https://curriculum.gov.bc.ca/curriculum/adst/9

https://curriculum.gov.bc.ca/curriculum/adst/10/courses

https://curriculum.gov.bc.ca/curriculum/adst/11/courses

https://curriculum.gov.bc.ca/curriculum/adst/12/courses

2) Workshop Implementation

The workshop starts with a presentation for the participants. Based on the grade and age of the students, the presentation may or may not include a short introduction to the World War II and some of those women who have specific roles in this war, or their lives style have been affected by it (See e.g. [1].) with focusing on Hedy Lamarr biography [2]. In the main part of the presentation the concept of the spread spectrum in data transmission, which for the first time was proposed by Hedy Lamar, is explained. The idea of spread spectrum data transmission will be cleared in the next section. However, based on this method in a communication system, the transmitter will access to many channels to send its data. It chooses one of them and switches to other ones quickly and almost randomly to send its data.

The way of switching between channels is known by the receiver and therefore it can follow the transmitter and detect all parts of the transmitted data. In lack of knowledge of transmitter channel switching, any jammer has no chance to get access the transmitted information [3-4].

Figure 1) Actress Hedy Lamarr was also an inventor of military technology [5]

After introducing Hedy Lamar, the rules of a game, designed based on her method is clarified for the participants. This presentation can be modified depending on the length of the workshop and the age of the participants.

Figure 2 shows the simulator system, named Toreh, which has been designed to illustrate the concept of the spread spectrum data transmission based on the proposed game. We explain it in detail with the following example.
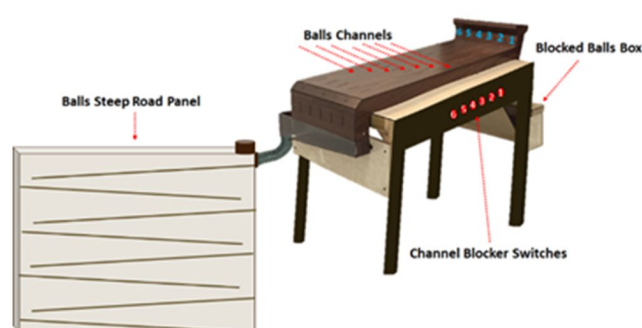
Figure 2) Toreh , a communication simulator system

Four students Titus, Miles from group A and Victor and Kevin from group B are ready to play the scenario. Titus and Miles play roles of transmitter and receiver respectively. Victor and Kevin have the role of noise. Titus and Miles receive a codebook which contains the codes of English letters (Table 1).

Code	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001
Character	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Table 1) The alphabet codebook

Titus is privately shown a message (e.g. HAPPINESS CANNOT BE FOUND). For each letter of the message, he finds its related code from the codebook.

Figure 3 shows the position of each student and their actions at Toreh.

Figure 3) Trajectory of the first ball (dropped in channel 2).

To send each bit of the code, Titus randomly chooses one of the 6 channels of Toreh and drops a blue ball for bit 1 or red ball for bit 0. For example, if he wants to send the first letter (H), he finds its code from the codebook (00111-See table 1.). As shown in figure 3, for the first bit, he has chosen channel 2. Independent of him and at the same time, Victor randomly blocks one of the channels by pushing one of the red keys. For the first b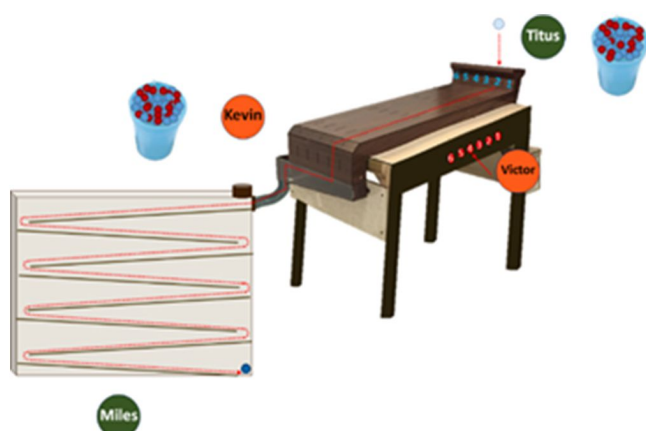it, he has blocked channel 4. Since he has blocked 4 rather than 3, Titus succeeds to send the first bit correctly. It means the blue ball goes to the down left corner of the Balls steep road. In this situation there is no chance for Kevin to have any action.

If Titus and Victor simultaneously had chosen a same channel, then Titus failed to send the first bit and the blue ball pushed back to the blocked ball box. In this case Kevin randomly drop a blue or red ball in the ball's steep road panel. Same procedure is down for the second bit, the third bit, etc. It continues for all letters and their related codes.

Figure 4 shows the situation after sending 30 bits correctly. Each bit has reached properly to destination; because Titus and Victor have chosen different channels or Kevin has dropped same ball as Titus in balls steep road panel. Hence, Titus has succeeded to send H A P P I N to Miles.). However, for the 31st bit which is 0, (Note that the code of E is 00100.), Titus drops a red ball in channel 5. However, Victor has blocked this channel (See figure 5.). Hence the ball is pushed back to blocked balls box. Simultaneously Kevin drops a blue ball in balls steep road panel. Hence a bit error occurred.
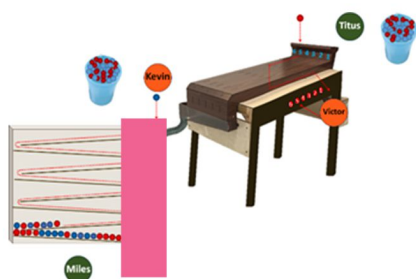

Figure 4) Victor has blocked the 31st ball.

Meanwhile, Miles who looks at the panel tries to decode and figure out the message. He needs to process the detected text to correct the errors. Once he detects the message, the game restarts by substituting the positions of group A and B. At this time Victor should send the message IF YOU SEEK IT FOR YOURSELF. The group whose receiver (Miles in group A, or Kevin in group B), finds the related transmitted message is the winner and goes for the next round.

In the simplest form Toreh may be used even for kindergarten students. On a board we have some pictures and their related codes. A students use these codes to send a message to his/her friends. For example, as shown in figure 5, Rose has sent the message "MOTHER has bought FLOWERS and ICE CREAM from MARKET". Note that for kindergarten students only one channel (channel 1) is used and all other channels and the channel blocking system are frozen.

Figure 5) Rose sends a short message to Jane.

3) Conclusion

In this paper a simulator system which has been designed to illustrate the spread spectrum technique in data transmission (A method invented by the actress Hedy Lamarr) was demonstrated. Examples were given to show how the designed system, which was named Toreh, can be used as a telecommunication system trainer for audience of different ages.

References:

[1] K. J. Atwood, "Women Heroes of World War II: 32 Stories of Espionage, Sabotage, Resistance, and Rescue", Chicago Review Press; 2nd edition, 2019.

[2] R. Rhodes, "Hedy's Folly: The Life and Breakthrough Inventions of Hedy Lamarr, the Most Beautiful Woman in the World", Vintage; Illustrated edition, 2012.

[3] D. Torrieri, "Principles of Spread-Spectrum Communication Systems", Heidelberg: Springer, 5th edition, 2022.

[4] R. L. Peterson, R. E. Zeimer, and D. E. Borth, "Introduction to Spread Spectrum Communications", Prentice-Hall, 1995.

[5] https://www.nbcnews.com/id/wbna46848978

An Interesting Method to Solve First Degree Equations

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Abstract:

In this paper we propose a simple method to solve equations of degree one. Regarding to the Gardner's theory of multiple intelligence, not only the logical and mathematical intelligence but also most of the other smarts of students directly or indirectly will be addressed by the method, having it in its comprehensive form.

1) Introduction:

This paper introduces a fun way for school age students to learn how to solve first-degree equations. The curriculum included in this document is suitable for an hour workshop with grade 3-6 participants.

First degree equations make part of every program of almost all primary school grades in all countries. For example, the relevant curriculum items for this activity in British Columbia, Canada are:

Mathematics 4-6 (One-step equations)

https://curriculum.gov.bc.ca/curriculum/mathematics/4
https://curriculum.gov.bc.ca/curriculum/mathematics/5
https://curriculum.gov.bc.ca/curriculum/mathematics/6

Mathematics 7 (Two-step equations)

https://curriculum.gov.bc.ca/curriculum/mathematics/7

There are standard and innovative methods to solve a first order equation, mostly done by rewriting and simplifying the equation, step by step. Some students tend to memorize the necessary steps to solve the equation without thinking about the reasons of why they should follow these steps. The proposed method is a physical scheme in which students participate in making parts of the equipment needed to conduct the method. In addition to their logical and mathematical intelligence, their visual-spatial, bodily-kinaesthetic, musical, naturalistic intelligences [1] also will be affected by the method. The details will be given in section 2.

2) Workshop Implementation

In this scenario each pair of participants receives the related kit which contains brown and white beans, origami hen boxes (puzzle boxes or toy boxes in hen or rooster shapes can be used instead of origami hen boxes.) and a river platform (See figure 1.).

Remark: In the following, please ignore all in { } phrases, if you want to perform the scenario for grades 1-4. Take them in account if you want to have the scenario for grades 5-7.
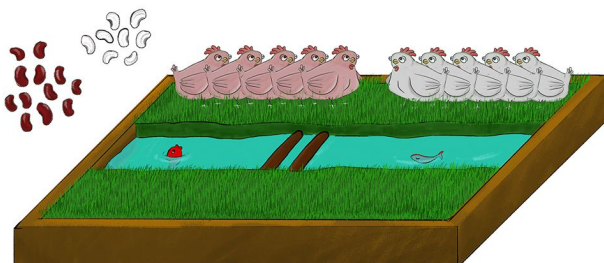
The teacher explains about some hens of pink {or white} color on one or both sides (Side A and side B) of a river. There are also some left brown {or white} beans on one or both sides of the river.

The following rules are given:

1-Each pink hen has eaten the same number of brown {or white} beans {(But not both.)} same as the other pink hens.
2-{Each white hen has eaten the same number of brown or white beans (But not both.) same as the other white hens.}
3-{The color of beans that pink hens have eaten are different of those the white hens have eaten, but the number of eaten beans for all hens are the same.}
4-{Each brown bean on one side can be eliminated by one white bean in the same side and vice versa.}
5-It is also known that the total beans (eaten by hens or left on turf) on both sides of the river are equals {(Considering rule 4)}.

The question is: In each installation of hens and beans on the sides of the river, according to the above rules, how many beans and of what color has each hen eaten?

By removing the equal hens, brown or white beans from both sides of the river, based on the above rules, the participants detect the number and the color of the eaten beans.

For example, consider the arrangement of figure 2.

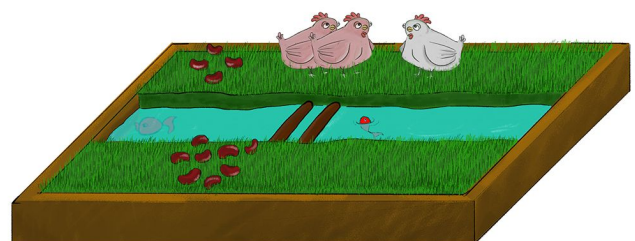**Figure 2)** A given arrangement

the students will remove the white hen and one pink hen from the related side because the brown and white beans inside them eliminate each other (See rules 3 and 4.). They also separate 4 brown beans from both sides (Based on role 4). The result is given in figure 3.
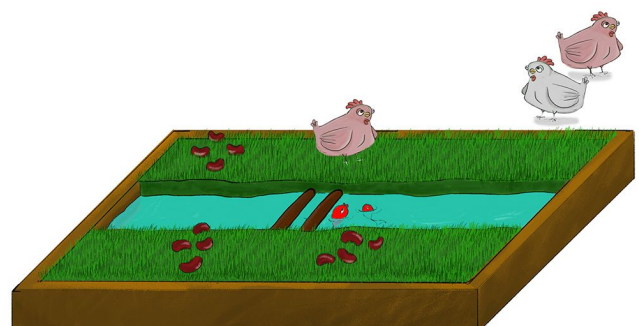

Figure 1) The necessary equipment

Figure 3) Removing the white hen and one pink hen.

Now it is clear that the pink hen has eaten four brown beans (See rule 5.). Hence, referring to the original problem, the two pink hens have eaten four brown beans each and the white hen has eaten four white beans. With this example, the students indirectly have solved the equation (See figure 1.):

$$2X+4-X=8$$

The teacher may have lots of examples for the students and can create many sub-scenarios from this activity. For example, figure 4 illustrates $2X+4-X=-8$.
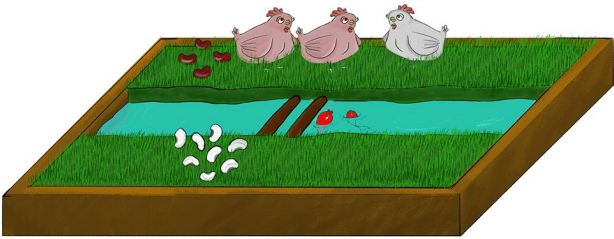

Figure 4) Illustrating $2X+4-X=-8$

Note that the last example should be considered for students of grade greater than 4. For grades 4 and less, only pink hens and brown beans should be considered. See table 1.

The following extra activities address the other smarts of the students:

1 Before starting the workshop give origami papers to students and ask them to make the origami hens [2]. It excites their visual-spatial, and bodily-kinaesthetic intelligences.

2 Play a music during the workshop where contains sound of beach, sound of hens or rosters, etc. It excites their musical smart (See e.g. [5].).

3 Having a snack made by egg and/or bean and talk about its ingredients, nutrition facts, etc., which enthuses their naturalistic intelligence (See e.g. [6] and [7].).

The proposed method has been conducted in three sample schools for students of grade 3 to 6. Almost all of the attended students enjoyed the game, learned and considered all of the game rules and even had correct answers when the solution value of equation was a fractional number (e.g. $3X+1=2$), or for contradiction cases (e.g. $X+1=X$) which there is no solution for them, or for trivial cases (e.g. $X+1=X+1$) which any chosen value for X is a solution for them.

Description↓ Equation→	X+4=7	2X+4=8	2X+4=-8	-2X-4+X=8+3X
No. of pink hens on side A	1	2	2	1
No. of pink hens on side B	0	0	0	3
No. of white hens on side A	0	0	0	2
No. of white hens on side B	0	0	0	0
No. of brown beans on side A	4	4	4	0
No. of white beans on side A	0	0	0	4
No. of brown beans on side B	7	8	0	8
No. of white beans on side B	0	0	8	0
No. of brown beans, eaten by a pink hen	3	2	N/A	N/A
No. of white beans, eaten by a pink hen	N/A	N/A	6	3
No. of brown beans, eaten by a white hen	N/A	N/A	N/A	3
No. of white beans, eaten by a white hen	N/A	N/A	N/A	N/A
The given example is appropriate for grade(s)	K, 1, 2	3, 4	5, 6	6, 7

We may have a large-scale form of the kit, designed on a table, which helps the instructor to better explain the rules of the activity on it for all students (See figure 5.).
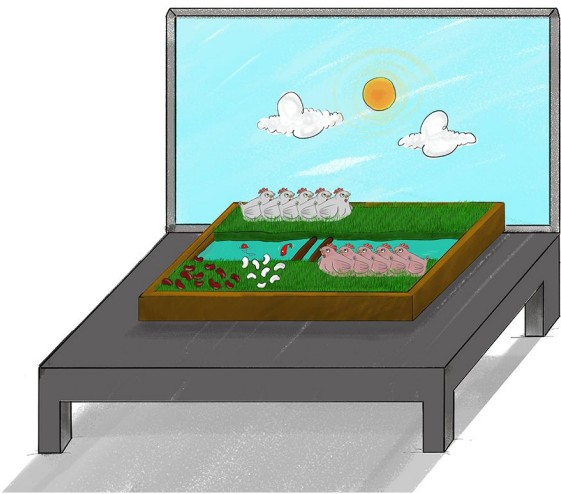

Figure 5) A large scale form of the kit.

3) Conclusion

In this paper an interesting and simple physical method to solve equations of degree one was proposed. The method can be conducted in such a way that in addition to their logical and mathematical intelligence, other smarts of students directly or indirectly would be addressed.

References:

[1] H. E. Gardner, "Frames of Mind: The Theory of Multiple Intelligences", Basic Books, 3rd edition, 2011.
[2] https://www.origamispirit.com/2014/02/origami-hen-box/
[3] G. Novak, "How to Cook for Beginners: An Easy Cookbook for Learning the Basics", Rockridge Press, 2019.
[4] R. Rashed, "Al-Khwarizmi: The Beginnings of Algebra", Saqi Books; Illustrated edition (July 11 2010)
[5] https://www.youtube.com/watch?v=msSc7Mv0QHY
[6] L. Steele, "The Fresh Eggs Daily Cookbook: Over 100 Fabulous Recipes to Use Eggs in Unexpected Ways", Harper Horizon, 2022.
[7] T. Hardeman, "The Bean Cookbook: Creative Recipes for Every Meal of the Day", Alpha, 2021.

Let's Learn Divide-and-Conquer Algorithms

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Abstract:

Divide-and-Conquer method plays an important role not only in scientific issues but also in human ordinary life. In this paper we show how some simple games, played by the primary school students, cause them to learn the concept of Divide-and-Conquer algorithms. Although the games are based on those Divide-and-Conquer algorithms which are parts of university courses, here the participants of each game are primary school students which intuitively learn the algorithms.

1) Introduction:

A Divide-and-Conquer algorithm divides an instance of a problem into two or more smaller instances. The smaller instances are usually instances of the original problem. If solutions to the smaller instances can be obtained readily, the solution to the original instance can be obtained by combining these solutions. If the smaller instances are still too large to be solved readily, they can be divided into still smaller instances. This process of dividing the instances continues until they are so small that a solution is readily obtainable [1].

The proposed scenario in this paper is a fun way for school age students to learn about Divide-and-Conquer algorithms and how a complicated problem can be divided into several sub-problems which are easy to solve. The curriculum included in this document is suitable for an hour workshop with grade 6-7 participants. As an example, the relevant curriculum items for this activity in British Columbia, Canada are:

Applied design, skills, and technologies 6 (Simple Algorithms)

https://curriculum.gov.bc.ca/curriculum/adst/6

Applied design, skills, and technologies 7 (Simple Algorithms)

https://curriculum.gov.bc.ca/curriculum/adst/7

2) Workshop Implementation

A Divide-and-Conquer algorithm is a best choice to solve many problems. As explained before, it works by recursively breaking down a problem into two or more sub-problems of the same or related type, until these become simple enough to be solved directly. We will demonstrate our two proposed activities which participants instinctively conceive the concept of the algorithms.

2-1) First Activity

In the first activity we have 85 black trominos in 'L' form and one foursquare domino in gray. We also have a 16×16 netted sheet. The question is: If the gray domino is put randomly on a 1×1 square area point of the netted sheet, is there any alignment of the 85 black trominos which covers all other points of the sheet with no vacant point(s). It can be shown that the answer to this question is yes. The left frame of Figure 1 shows a randomly chosen place where the gray domino has been laid on.

To complete the sheet we divide it into four equal areas as shown in figure 1. A tromino is placed in the centre of the sheet in such a way that each of the three areas which do not contain the gray domino (Areas 1, 2 and 3 in our example) has a black square. Now all of the four areas have one square domino in. The procedure is repeated for these areas and each of them is divided into four same subareas. A tromino is placed in areas 1, 2, 3, and 4 in such a way that each subarea contains a black or gray square. The procedure continues for all sub-areas (Dividing them to four sub-subareas and…) till the sheet is covered by trominos.
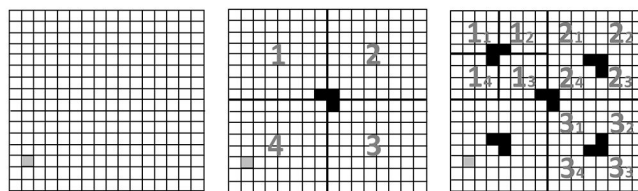

Figure 1) Trominos, netted and divided sheet

What explained is a clear form in engaging a divide and conquer algorithm to solve a problem. The method is used as a game for the students to learn more about this algorithm.

A 16×16 netted sheet is in front of four students (The participants are in groups of four members.). Each student of a group of four students receives 21 black trominos (Figure 2).

Figure 2) Netted sheet in front of the students

The last black tromino will be left for the teacher who randomly chooses a box out of 256 boxes of the sheet and puts a gray square domino on it. Now the teacher asks the students to arrange their trominos on the sheet in such a way that all boxes are covered by the trominos. He/She also indicates that the last black tromino will be given to anyone who asks for. Without any plan, usually it takes long time to complete the procedure (Figure 3).

Figure 3) Students have been asked to cover the sheet..

After some tries and fails, the teacher puts the last black tromino on the sheet in such a way that one box of each quarter of the sheet becomes covered. With this action he/she has divided the problem to four easier sub-problems (See figure 4) or equivalently has chosen a Divide-and-Conquer algorithm. Then he/she asks each student to watch only their related quarter and think about how they can cover it.

Figure 4) Teacher puts the last dark-blue domino on the sheet

Now each student should solve a simpler problem. With the teacher's clue, they learn to consider a same idea in their related quarters and rapidly complete their territories.

Figure 5) The final result.

2-2) Second Activity

By two-way merging we mean combining two sorted arrays into one sorted array. By repeatedly applying the merging procedure, we can sort an array. For example, to sort an array of 16 items, we can divide it into two subarrays, each of size 8, sort the two subarrays, and then merge them to produce the sorted array. In the same way, each subarray of size 8 can be divided into two subarrays of size 4, and these subarrays can be sorted and merged. Eventually, the size of the subarrays will become 1, and an array of size 1 is trivially sorted [1] (See figure 6).
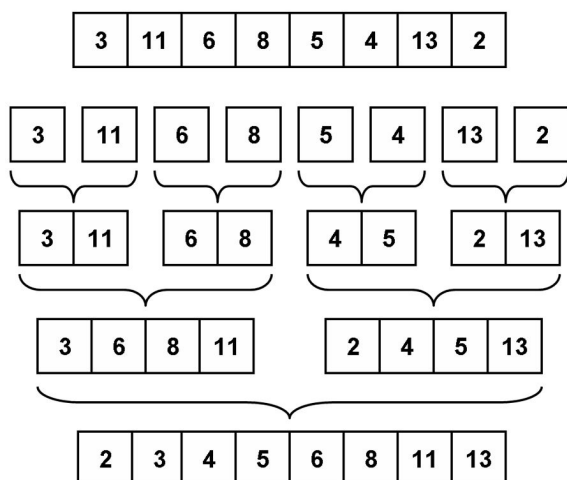

Figure 6) An example of done steps in a two-way merge sorting

Instead of numbers, we use the merge sort in nouns sorting. 1000 or more visit cards will be distributed between the students (Figure 7).
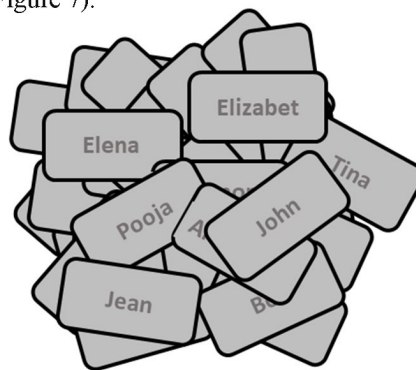

Figure 7) Visit cards

They should sort their cards based on the names on them. Each student sorts those cards he/she has and then each two students make a pair and merge their sorted cards rapidly. The sorted cards then merge to the sorted cards of one of the other pairs and it continues till all cards become sorted.
Slicing an apple to eat it.
When the attended students complete the mentioned activity, the teacher may ask them for the role of Divide-and-Conquer algorithms in human life. These are some examples:

- Folding a shirt to put it in a packet.
- Disassemble a heavy item for storing.
- Using both hands to carry multiple shopping bags.
- Looking in each room separately for something that we have lost around the house
- Wearing shoes, shirts, etc. (Wear right (left) shoe and then wear left (right) shoe.)

The name 'Divide and Conquer' comes from the strategy that martials sometimes consider in their fights (e.g. follow Julius Caesar and Napoleon Bonaparte wars.) [2]. The details can be considered on a monitor in which also we have something about Al-khwarizmi that the word 'algorithm' comes from his name [3].

Figure 8) History of the word "algorithm" and "Divide-and-Conquer".

3) Conclusion

In this paper two interesting games were demonstrated. The games were based on Divide-and-Conquer algorithm and in conducting both games, participants have direct roles. Some examples of ordinary life in them we use Divide-and-Conquer algorithms were explained.

References:

[1] R. Neapolitan, "Foundations of Algorithms", Jones & Bartlett Learning, 5th edition, 2014.
[2] A. Mikaberidze, "The Napoleonic Wars: A Global History", Oxford University Press, 2020.
[3] C. Brezina, "Al-Khwarizmi: The Inventor of Algebra", Rosen Central, 2005.

An Illustrative Method in Learning the Fibonacci Sequence

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Abstract:

The Fibonacci sequence plays an important role in nature and human life. This proposed workshop is based on a three-episode scheme. Students of grades 5-7 step by step are directed to the concept of this sequence. Two dolly characters have the main role in all three episodes. The results of executing the proposed method in various schools show how the proposed method helps the students to learn about the variables with indices, their contents and recursive relation between them.

1) Introduction and Preliminaries

This workshop is a fun way for school age students to learn step by step about a number pattern which is named Fibonacci sequence. The curriculum included in this document is suitable for an hour workshop with grade 5-7 participants. The related kit can be used for illustrating some other patterns.

Relevant curriculum items for this activity are:

Mathematics 5 (Rules of patterns)

https://curriculum.gov.bc.ca/curriculum/mathematics/5

Mathematics 6 (Rules of patterns)

https://curriculum.gov.bc.ca/curriculum/mathematics/6

Mathematics 7 (Discrete linear relations)

https://curriculum.gov.bc.ca/curriculum/mathematics/7

Dinosaur Dio and duck Duki, having a strong friendship between themselves, are the main characters of the proposed workshop.

Figure 1) Three shots of Dio (Left) and Ducki (Right)

Each pair of participants will be given the following items (See figure 2.):

1-Ducki and Dio

2-White sticky notes

3-Yellow Star Sticky Notes (SSNs)

4-Pinky SSNs

5-Blue cardboard

Figure 2) Participants' given items.

and will be asked to form what has been shown in figure 3.
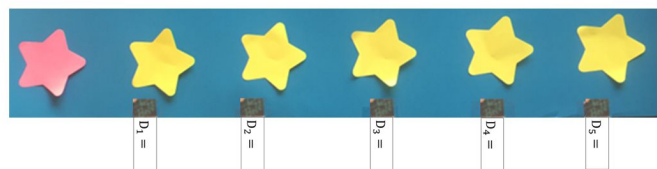

Figure 3) What the participants should perform.

Note: For expression simplicity, in the following, we identify the sticky notes according to their positions on the cardboard (as shown in figure 4.).
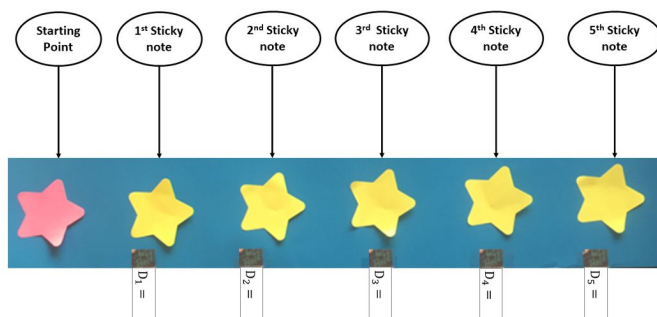

Figure 4) Identifying the SSNs and their related white sticky notes

2) Episode 1

The instructor puts a pinky SSN on the 1st yellow SSN, puts Ducki at it and puts Dio on the starting point (figure 5).
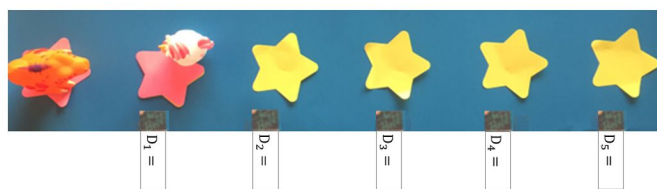

Figure 5) The first Dio and Ducki alignment.

Then the instructor explains:

Dio when it is on a SSN can jump only on the next SSN. Based on this rule, he/she asks:

In how many ways it can reach to Ducki?

Obviously, there is only one way, and each pair of participants should note 1 on the 1st white sticky note of their kit (See figure 6.).

Notation: The amount of D_n, n=1,2,3,… shows the number of way(s) Dio can meet Ducki at the nth SSN.
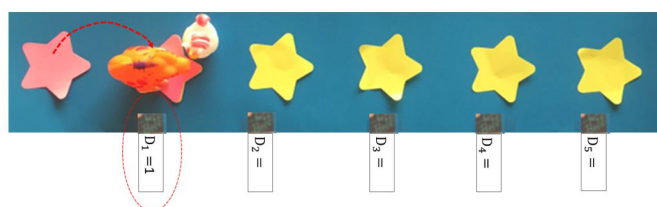

Figure 6) Only one way for Dio to meet Ducki at 1st SSN

Now the instructor changes the situation into what you can see in figure 7.
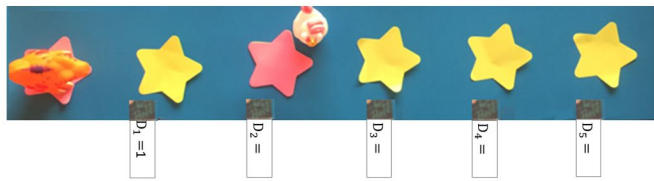

Figure 7) Ducki at the 2nd SSN.

and asks:

If as before Dio, on a SSN, can only jump on the successive SSN, in how many ways it can reach to Ducki?

Obviously, there is only one way, and each pair of participants should note 1 on the 2nd white sticky note (See figure 8.).
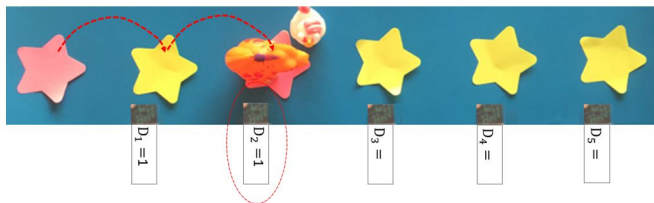

Figure 8) Only one way for Dio to meet Ducki at 2nd SSN.

This procedure can be performed for other yellow SSNs (See e.g. figure 9 for Ducki at the 4th SSN.) to find out that: $D_3=1$, $D_4=1$, $D_5=1$.
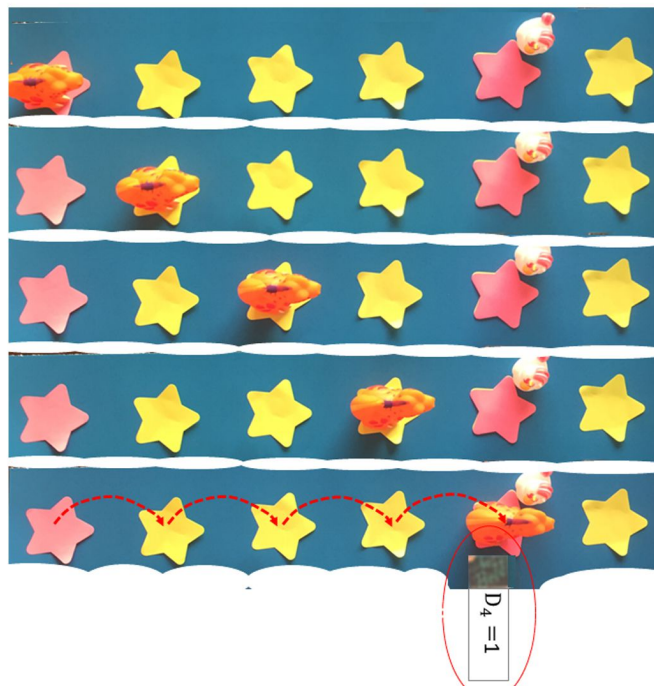

Figure 8) Dio meets Ducki at the 4th SSN.

At the end of this episode of the workshop, the instructor asks some questions:

What does the index 3 mean in D_3?

How do you imagine D_{100}? What is the amount of D_{100}?

What is the relation between $D_1, D_2, D_3, \ldots$?

3) Episode 2

Now consider the rule that when Dio is on a SSN, it can jump only on the second next SSN. Based on this rule, we have $D_1=0$; because there is no way for Dio to reach Ducki (When Ducki is at the 1st SSN (See figure 10.).).
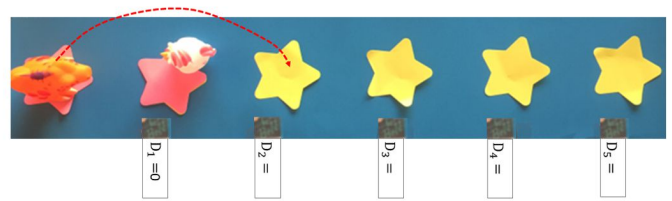

Figure 10) Dio cannot meet Ducki, if it is at the 1st SSN.

However, there is only one way for Dio to reach Ducki, if Ducki is at the 2nd SSN. Same discussion shows that (See figure 11 for $D_4=1$.): $D_3=0$, $D_4=1$, $D_5=0$.
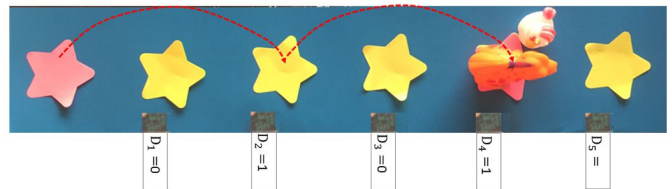

Figure 11) The unique way for Dio to meet Ducki at the 4th SSN.

The instructor repeats his/her questions for this episode:

What does the index 3 mean in D_3?

How do you imagine D_{100}? What is the amount of D_{100}? What about D_{101}?

What is the relation between $D_1, D_2, D_3, \ldots, D_{100}, D_{101}$?

4) Episode 3 (The Fibonacci sequence)

Now the students are ready to learn the Fibonacci sequence and we have the last episode of the workshop.

Consider the rule that when Dio is on a SSN (or on the starting point), it can jump on the next SSN, or on the second next SSN. We are going to compute D_1, D_2, D_3, D_4 and D_5 in this case.

Obviously, we have $D_1=1$; because there is no other choice for Dio to reach Ducki when Dio is on the starting point and Ducki is at the 1st SSN, except to jump on the 1st SSN (See figure 6.).

Based on Dio's abilities in jumping, it has two choices to reach Ducki, when Dio is on the starting point and Ducki is at the 2nd SSN. It means $D_2=2$ (See figure 12.).
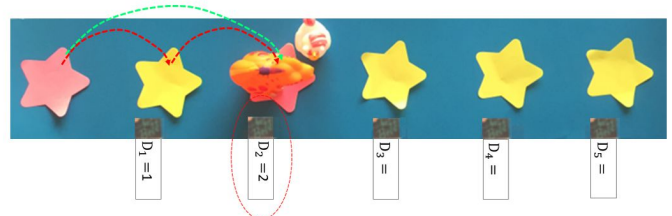

Figure 12) Two choices for Dio to meet Ducki at the 2nd SSN.

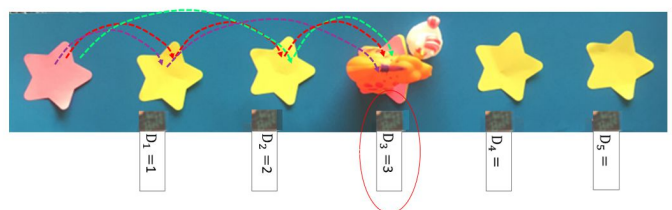Same discussion shows that $D_3=3$ (See figure 13.).

Figure 13) Three choices for Dio to meet Ducki at the 3rd SSN.

With checking all possible ways, we will find out that $D_4=5$ (See figure 14.).
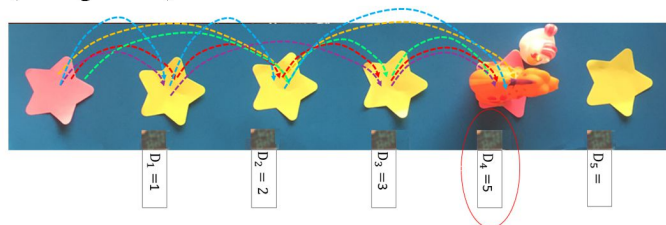

Figure 14) Five choices for Dio to meet Ducki at the 4th SSN.

In comparison to episodes 1 and 2, it can be verified that computing the amount of D_5 is hard. Instead of, a logical discussion leads us to $D_5=8$. Dio, being on the starting point, to reach Ducki which is at the 5th SSN, may jump on the 1st SSN or jump on the 2nd SSN. If it jumps on the 1st SSN, then the situation to meet Ducki is same as the case where it is on the starting point and wants to reach Ducki which is at the 4th SSN (See figure 15.). Hence, in this case, there is $D_4=5$ ways to reach Ducki.
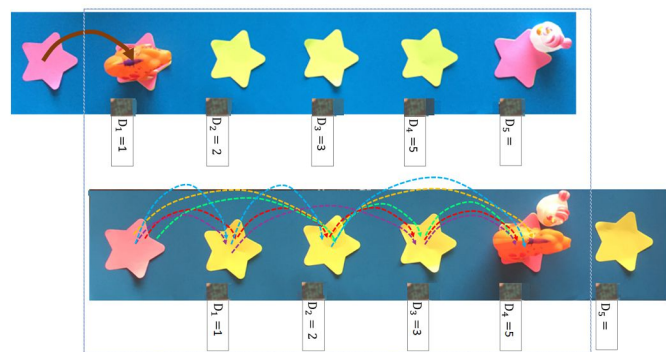

Figure 15) To meet Ducki at the 5th SSN, Dio has jumped on the 1st SSN.

When it is on the starting point, jumping on the 2nd SSN, is the second choice for Dio to reach Ducki at the 5th SSN. As shown in figure 16, in this case, the situation is same as the case where it is on the starting point and wants to reach Ducki which is on the 3rd SSN. Hence, in this case there is $D_3=3$ ways to reach Ducki.
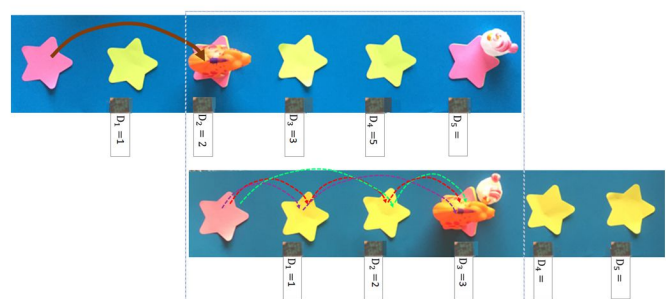
Figure 16) To meet Ducki at the 5th SSN, Dio has jumped on the 2nd SSN.

As a result of the above discussion the total ways that Dio, beginning from the starting point, can reach Ducki, is:
$$D_5=D_4+D_3=5+3=8$$
The students also can check out that:
$$D_4=D_3+D_2=3+2=5$$
The instructor has some questions for this episode:
What is the amount of D_6? What about D_7? What do the amount of them mean?
What is the relation between D_7, D_8 and D_9?
What is the relation between D_9, D_{10} and D_{11}?

How can we compute D_{25}?
What are the missed indices in the following relation:
$$D_9=D_7+D_?+D_5+D_?$$
What are the next 5 numbers in the sequence:
$$1,2,3,5,8,13,21,34,\ldots$$
The above sequence is named Fibonacci sequence.

Acknowledgment

References:

[1] R. Neapolitan, "Foundations of Algorithms", Jones & Bartlett Learning, 5th edition, 2014.

A Memorable Day in my Life:

I do not forget that special day in my life. I was in grade 3 and I had a permanent nose congestion. I hospitalized and an unavoidable surgery was done in 2 hours. When nurses returned me to the recovery room, I was unconscious. I was told it took about 40 minutes before I became conscious. I opened my eyes. Everything was dim. However, I recognized my mom, looking at me lovingly, worried but tried to be calm. My sister also was there looking at me warmly. But, far from them a pair of eyes also was looking at me, lovingly, same as my mom, warmly same as my sister. They didn't know who she was and why she had been there even before they arrived. But I knew her. She was my teacher, Ms. Sattar, with two books in her hand, brought for me. How she had noticed in which hospital I was, didn't matter. For me it was a miracle having my lovely teacher. She had a new lesson for me: Think about your students; everyday, everywhere.
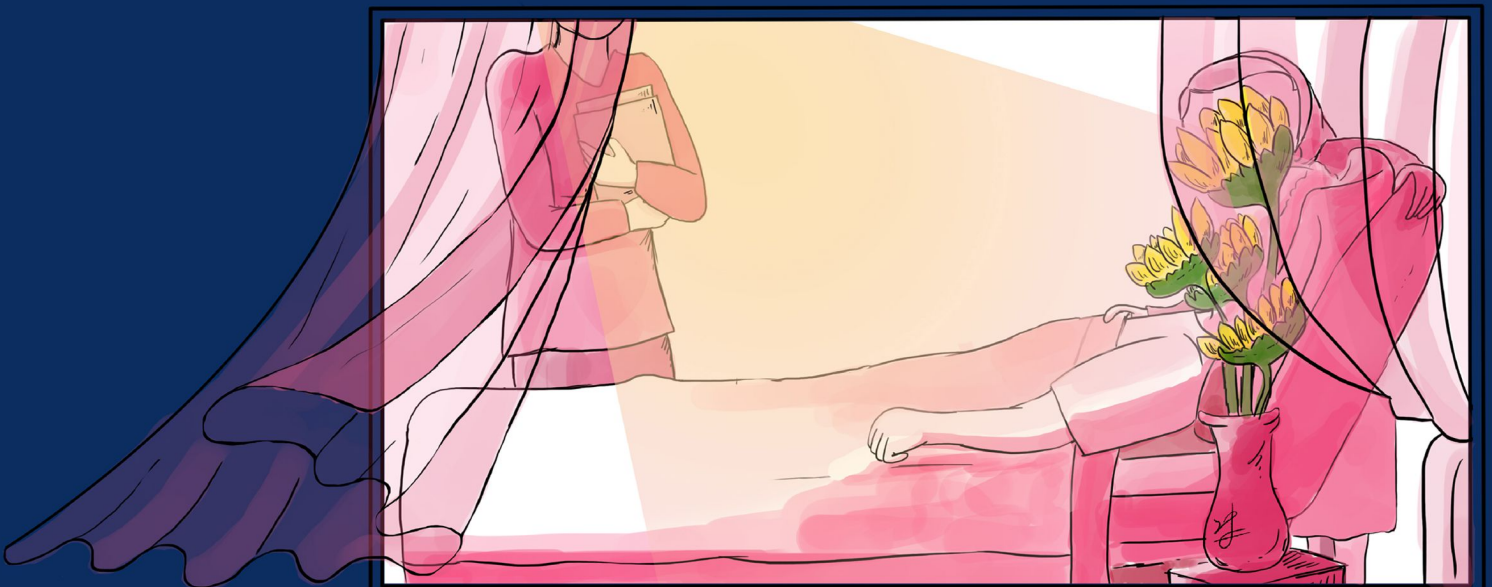
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By: Mahnaz Yazdani

Call for Papers

Topics in Education for PreK, K-12 Students, Children with Disabilities, Autistic Children, Ingenious Students, Elders and more.

The CCK Clerestory is an international magazine for professional and modern education that is published quarterly. Research papers focusing on proposed innovative workshops, scenarios, and methods in education make significant part of the magazine.

Articles submitted for publication in the magazine must be related to topics of interest and clearly demonstrate that the information conveyed in the article is research based. The published high-quality papers report theoretical and experimental advances which include but are not limited to one or more of the following forms:

1- Propose a theoretical or practical method, which helps a complicated scientific problem or concept in math, science, art, history, economics, etc., becomes understandable for someone in kindergarten, primary or secondary school grade or for a specific group of society (e.g. elders, children with disabilities, autistic children, ingenious students, etc.).

2- Illustrate how a well-known rule, theorem, method, etc., has specific role in modern technology, science, math., art, sport, etc.

3- Demonstrate the details of assembling an equipment or device which has been designed by the authors to improve the performance of education in a specific field.

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All articles submitted for publication must be subjected to a peer review process and must be approved by a minimum of two peer reviewers selected by the Editorial Board. Once approved, the article is then submitted to the Editor-in-Chief for consideration and final approval. Should an article submitted for consideration not receive approval, it may be returned to the author for major or minor changes.

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• It is the corresponding author's responsibility to ensure the paper is not or has not been under consideration (in any form) by any other journal, magazine or any other publisher at the time of submission.

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The Paper Template of the Magazine

Instructions and Formatting Rules for Paper Authors of
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[1]Affiliation per author if desired, Department name of organization,
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[3] Affiliation per….

Abstract:

In this template, the basic instructions for the submission of a paper to the CCK Clerestory Magazine are presented. Please note that this magazine has the right to reject any paper submitted not according to the predefined styles without further inspections. The abstract is limited to 200 words. It should concisely state what was done, how it was done, why, and what are the primary result and its significance. The abstract cannot contain details, figures, tables, equations, or references.

Keywords: Up to 6 keywords shall be provided as index terms.

1. Paper Sections

This document provides an example of the desired layout for the CCK Clerestory Magazine using Microsoft Office Word 2007[1]. It contains all required styles for the paper. For preparing your manuscript consider the following items:

- The paper should be typed in a two-column, single-space format, on A4 paper size. Set top margin to 3 centimeters and bottom, left and right margins to 2 centimeters.
- Maximum number of pages is 6.
- The size and type of the font is shown in Table (1).
- Use "Times New Roman" font for your text. Italic font can be used for variables or for an emphasized phrase.

Table (1): Sizes and type of require font

Situation of Using	Font Type	Font Size
Paper Title	Bold Times New Roman	15
Authors' Names	Times New Roman	11
The First Section Heading	Bold Times New Roman	12
The Second Section Heading	Bold Times New Roman	11
The Third Section Heading	Bold Times New Roman	10
Abstract and Keywords	Times New Roman	10
Subscripts	Times New Roman	10
Figures and Tables Title	Bold Times New Roman	10
Figures and Tables Text	Times New Roman	9
Equations	Times New Roman	10
References	Times New Roman	9
Main Paper Text	Times New Roman	10

2. Your Paper Formatting

Each paper must contain keywords, introduction, main text, conclusion, and references. Other items such as acknowledgment, appendixes and subscripts are arbitrary. These sections will be placed before references. The section numbering starts from 1 and the ending section contains conclusions. Each section may or may not contain subsections. Additionally, be sure that your sentences are complete and that there is continuity within your paragraphs. Check the numbering of your figures, tables and graphics and make sure that all appropriate references are included. All paragraphs should be indented 0.5 centimeter. Please avoid from long paragraphs.

2.1 Abstract and Keywords

Abstract must express subject and results of your research. Abstract should only explain the major contribution of the paper and other details, figures, tables, equations, and references should not be included.
If abbreviations are used in abstract, keywords and any section of the paper, the complete phrase must be written for each abbreviation, once it appears for the first time in abstract, in keywords, and in the rest of the paper.

2.2. Introduction

In this section you clearly explain if you have:

6-Propose a theoretical or practical method, causes a complicated scientific problem or concept in math, science, art, history, economics, etc., becomes understandable for someone in kindergarten, primary or secondary school grade or for a specific group of society (e.g. elders, children with disabilities, autistic children, ingenious students, etc.).
7-Illustrate how a well-known rule, theorem, method, etc., has specific role in modern technology, science, math., art, sport, etc.
8-Demonstrate the details of assembling an equipment or device which has been designed by the authors to improve the performance of education in a specific field.
9-Propose innovative and proven methods or directions to improve teaching performance.
10- Contain the results of an inter-disciplinary or cross-disciplinary research on education.

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For example: "This paper demonstrates a scenario which is a fun way for school age students to indirectly learn about a special method in data transmission". The related curriculum and the related school grades, or the specific group of society (e.g. elders, children with disabilities, autistic children, ingenious students, etc.) which the paper will be associated to them should be identified in the first section. A literature review of those who have direct role on the concept of the proposed work, other methods in the related field and the subject of the paper must be addressed in this section. Then the justification of using the new contribution must be explained and, in the end, authors should briefly explain the main contribution of the work.

2.3 Main Text

After introduction, the main body of the paper in one or more sections should be expressed. These sections must contain the primary significance, the details of executing the proposed scenario, game, etc., details of any equipment which has been designed for the proposed method, and supportive evidence for any innovative proposed method in teaching. Please only focus on the subject of the paper and try to keep the continuity and hierarchy of the subject.

2.4 Conclusions

In this section the contribution of the paper must be described as clear as possible. A summary of important results should be given.

2.5 References and Citations

Reference section should be placed at the end of the paper without any numbering. The reference citations are consecutively given in square brackets [1]. The sentence punctuation follows the brackets [2]. Use commas for multiple citations like this [3, 4]. Dash can be used for referring of successive references (e.g. [1-5]). Refer simply to the reference number, as in [6]. Do not use "Ref. [6]" or "reference [6]" except at the beginning of a sentence: "Reference [6] shows…".

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3. Figures and Tables

Each figure or table must have a number and a caption. In figures, the number and caption appear under the figure while in the tables, they appear above. All figures and tables must appear near, but not before, their first mention in the text. All figures and tables must be having appropriate quality and be referred in the paper. The size of the text and the number in tables and figures must be suitable to allow high legibility. Initially capitalize only the first word of each figure caption and table title.

Use the abbreviation "Fig. 1", even at the beginning of a sentence. Figures and tables must be numbered separately. Use words rather than symbols or abbreviations when writing figure axis labels to avoid confusing the reader. As an example, write the quantity "Student Reflection", not just "S. R.".

Also Figures and tables must be placed in the middle of column. Please select figures layout "In line with text". Fig. 1 is an example with this setting.
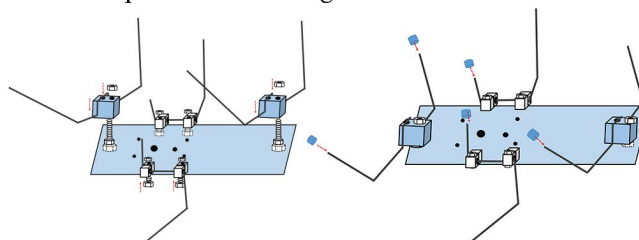

Fig. 1. Details of robot assembling

4. Equations

For demonstrating equations in the paper use the "Microsoft Equation Editor" to create equations. Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1).

All variables, parameters and symbols of a mathematic equation must be described. For example:

$$f_n = (n-1)(f_{n-1} + f_{n-2}) \tag{1}$$

where f_n is....

If there are a lot of variables, you can explain your approach in notation arrangement or use nomenclature at the end of section 1.

Refer to "(1)," not "Eq. (1)" or "equation (1)," except at the beginning of a sentence: "Equation (1) is ...". All equations must be referred after writing the equation in the text.

5. Conclusions

In this paper, specification of a printable paper in the CCK Clerestory magazine was explained….

Please avoid from using general and cliche sentences in this section and only give the main results in a clear manner.

Appendix

Appendixes, if needed, appear before the acknowledgment. Subsections for this part should be also numbered by alphabets. This section can contain data and information of a case study, details of equipment assembling, etc.

Acknowledgment

The following is an example of an acknowledgment:
The authors gratefully acknowledge Ms. ST, Principal of UV school, where we conducted the proposed workshop and documented the results.
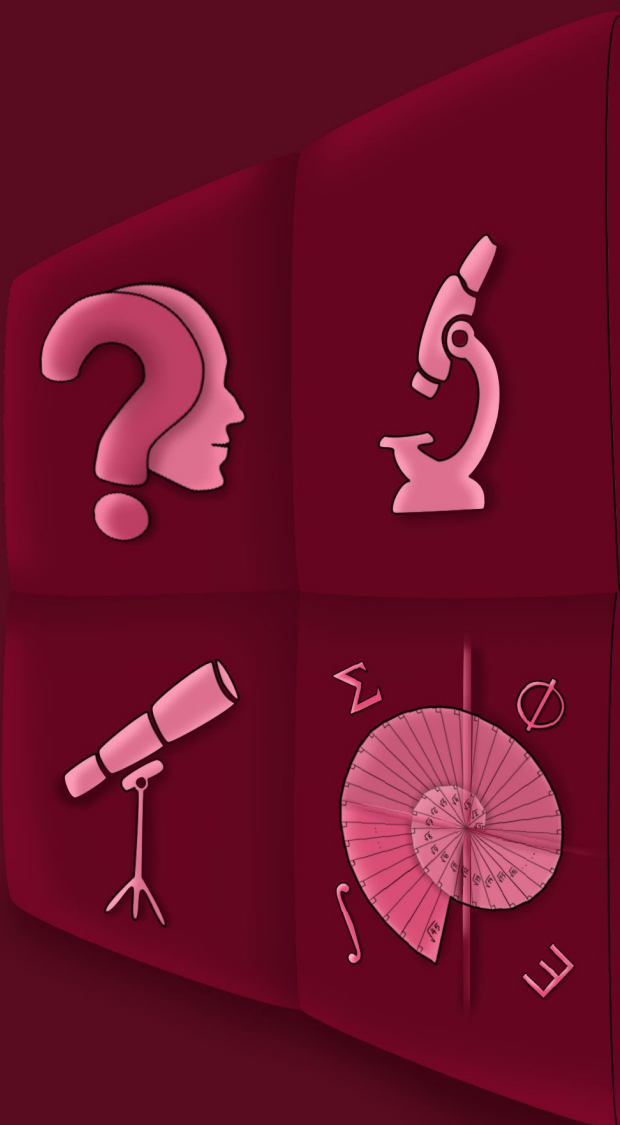
References

In the following you find examples (Book, Journal paper, Website) of the format you should consider in your paper.

[1] R. Rhodes, "Hedy's Folly: The Life and Breakthrough Inventions of Hedy Lamarr, the Most Beautiful Woman in the World", Vintage; Illustrated edition, 2012.

[2] K. T. MacKenzie, C. A. Mazefsky, and S. M. Eack, "Obtaining a First Diagnosis of Autism Spectrum Disorder: Descriptions of the Diagnostic Process and Correlates of Parent Satisfaction from a National Sample", Springer, Journal of Autism and Developmental Disorders, Vol. 52, Issue 8, Aug. 2022.

[3] https://curriculum.gov.bc.ca/curriculum/adst/12/courses