A Cooperative Learning Approach towards Cell Biology

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Abstract The problems in educational field are not new, many educators and researchers are continually seeking ways and effective approaches to increase student achievement and outcomes. The biology education is however a crucial problem that needs to be solved, the problems in science education are amplified where educational and teaching approach plays critical role. In this paper, cooperative learning approach has been utilized to solve the problem of cell biology teaching, because it motivates students in ways that traditional approach does not. The cooperative learning provides an opportunity to students to enhance communication, social, critical thinking and problem-solving skills. The reason this approach is suitable for effective teaching is that it provides active learning roles to students, rather than traditional learning where students have passive-learner role to fulfill. A step-by-step implementation plan for cooperative learning in cell biology teaching has been presented in this excerpt which is beneficial for teachers and educational leaders in the field of science.

Keywords: approach, biology, cell, cooperative learning

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1. Introduction

The instructional approach towards teaching science has always been an area of study for stakeholders. The educational leaders seek ways in which instructional approach can be improved to increase educational outcomes. Teachers’ goal includes making students learn to an extent such that it brings change in their lives. In this paper, the problem of teaching cell biology to students using cooperative learning model is the major focus. There are evidences that lack of effective curriculum and instructional approaches exist in the field of science education, in result, most students desist from choosing science subjects or they switch to some other majors [1]. It can be said that the culture of classroom and the process and style used for teaching all contributes, inadvertently, to less interest of students in the science education. The education of biology, thus, is in crisis situation due to several reasons where instructional approach and teacher preparation is a big concern. Keeping this problem in mind, this paper proposes cooperative learning to effectively teach significant topics in biology.

Cooperative learning is a well-organized, frequently researched, and effective approach in teaching practice. It is different from individualistic or competitive learning since it requires students to work in a group, or team. The students learn and gain experiences in a collaborative effort, students become partner’s mere resources of learning. The success is determined, in cooperative learning environment, by the involvement of the members in a group. There have been numerous amounts of studies that recommend the cooperative learning method for teaching biology topics. Those supporting studies claim that when students come together in learning they are able to stimulate their minds and solve challenging problems in student-oriented way: information achieved from such a method is long term and reliable as compared to teacher-oriented instruction [2].

Cooperative learning benefits include enhancing students’ learning experience, as well as influencing positive attitude towards science education in students. The significance of instructional approach in increasing student interest cannot be overemphasized. Here, literature reviews to support the hypothesis that cooperative learning can bring positive change in teaching Biology will be presented. The benefits of cooperative learning in increasing the effectiveness of instructional approach will be visited, in addition to that; Cooperative learning lesson plan will be presented for teaching cell biology to students. Most of the teachers are still not aware of the benefits of cooperative learning and thus they rely upon the outdated and traditional methods of teaching where Cell biology is taught as subject-matter material. It is all about memorizing and learning nothing that could be used by students in their real life [3].

2. Literature Review

Cooperative learning is a defined and structured manner for using tiny groups to improve student education and interdependence. Students are assigned a group activity so that they could work collectively in a cluster to accomplish that assignment. Each one in the group is given responsibilities and is responsible for the conclusion.
of the assignment; therefore, it’s more a team effort for the success of that group [4]. It usually takes some time for both the coaches and the students to get used to team effort or combined activities. It might require frequent efforts to get in line with the combined effort and fully cognizant of the group activities for both coaching and education seeking. These kinds of group usually comprise of different sets of students having different talents, skills and strengths such that one member of the group might be very good at sketching, while others have good writing or presentation skills [5].

Different Students can be given different numbers so that it could be easy for them to work repetitively with the fellows at least once in every year, single number system may ease any misunderstanding and assist in determining tasks for each group or class of students [4]. While evolving assignments, there are numerous approaches for development of projects. Think-pair-share approach is one of the approaches; students are modeled for a query which needs to be gauged. The process is initiated in a way that first of all students are given a specific topic to think over and jot down their ideas on specific topic and subsequently, whole bunch of students in a class could be asked to indulge themselves into group dialogue or discussion to share their views/ideas. How students interrelate or intermingle with each other is frequently an ignored feature of coaching [4,6].

Significant amount of time is invested over the coaching of teachers so that they could handle creation of environment where students learn how to behave interactively with each other [4]. In fact, in the new era of learning, teachers are also trained in a manner such that they could proactively learn how to interact with the students in an effective manner so that it yields overall better results for both the mentor and the student. How the teachers design or create student to student interaction phenomenon or scenario, has a huge impact on the outcome of students learning, how well they become cognizant of the school or the environment in which they exist and resultanty, how much self-confidence they have developed [5]. The idea behind cooperative learning is that one shares his own knowledge with the group and he learns skills and gain knowledge from others within the group. After the application of cooperative learning methodologies in the learning medium, one can reap the following aids:

It’s a fun activity so that students could adore it and are inspired. The outcome of the activity is dependent upon the group work, so everyone in the group has to contribute his share. Cooperative learning permits sharing of ideas and views which result in longer information retention by students. Cooperative learning enables students to work in synergies and know the importance of cumulative efforts and output for the achievement of their goals and targets [4].

Since late 1980s, cooperative learning was not even known and eventually disregarded by the coaches/instructors. Primary, secondary and in fact academia learning was dominated by competitive and distinctive mode of learning. The resistance to cooperative learning was grounded on the theme that students have to survive in a hostile environment outside the academia. However, this perception is changed now, and more emphasis is being laid on group activities, combined efforts and synergies [5]. On the contrary, cooperative learning is now accepted and often favors instructional process at all stages of education. Today this mode of learning is being widely used worldwide in every subject area and with all age students. Cooperative learning is now a highly endorsed medium of education in all parts of the world. In each classroom, educational activities are designed in such a way that common goal is achieved. It actually depicts a win-win approach for all the stakeholders as all goals are shared [4].

There have been many changes and modifications in the approaches and styles of teaching in education; this could be because of the advancement in science and technology. The educational philosophy serves the major purpose of the curriculum design and shaping the role in education. The significance of novel methods and effective teaching techniques has been verified by many researches and by the American Psychological Association report 2061 [7].

It has been claimed that there is a need for modification and innovation in the field of education; reforms at all levels are necessary. It is the demand of these times that science must provide enough assets to students so that they can face the hurdles of current environment and struggle in day-to-day life. Knowledge alone would not be sufficient for students to survive in this ever-changing competitive world. It is essential that students are improved in various areas such as communication skills, critical thinking aspects, leadership traits and qualities, and other necessary reading and listening skills etc. With such high visions, it is implausible to expect that traditional teaching style would service the purpose of making students an all-rounder in life. Therefore, innovations are necessary in the teaching styles [8].

CRISIS IN BIOLOGY EDUCATION:

Effective teaching is the main purpose of education and learning. The teachers must use strategies and approaches that can increase students’ understanding and outcomes. Biology teaching is quite challenging because there are many hardships which students have to face while learning concepts of biology [9]. Students find the curriculum of biology overloaded with difficult concepts, the abstract nature of the topics and the textbooks are often regarded as among the barriers to effective biology education. Many reasons and evidence have been found in research that suggests that students have difficulties in understanding biology. The study by Chiappetta and Fillman [10] claims that biology is much overloaded with concept, it adversely effects motivation in students’ interest; they are likely to pass their course through memorization technique without understanding.

The teaching styles and the techniques used to teach biology are among factors that affect learning in students as determined by Çimer [11]. When students are not satisfied with the learning approach they tend to skip or withdraw from learning activities. Students’ effective biology learning has been found to be linked with their perception towards teaching of biology [12]. It is found by Telli, Brok, Tekkaya, and Çakıroğlu [13] that the way students perceive their class environment significantly affects their general attitude towards learning biology. This suggests that teachers need to review the current teaching approaches [14].
Students’ perception towards biology education has been found to be dissatisfying for many reasons. They claim that they found the nature of biology to be complex: they tend to use memorization techniques to memorize the facts. This could be because of the teaching style as most educators use the traditional way of teaching and they do not make an association between biology and daily life application. The lack of practical implication and experimentation has also been linked to difficulties in students [14]. This calls for reforms of educational strategies and teaching style that is used to teach biology, especially in cell biology education [14]. Cell biology is among the important modern science of daily life, it consists of studies about fundamentals of cell at molecular and microscopic levels. Cell is the basic part of human beings, the functions taking place in the cell is extremely crucial for human lives. Currently the teaching approaches which are used in biology and cell biology education includes: laboratory and lectures. The teachers are, in great numbers, using traditional methods of teaching biology such as lectures [15].

**Lectures:**
The teacher provides introduction to the biology topics, and the main knowledge. In this approach, teachers also use PowerPoint, videos and other components to make the lecture appealing and interesting. However, the roles of teachers remain active, teacher-centered format, where student play a passive-learners’ roles. Sometimes teachers use concept mapping technique to make students understand the difference between plant cells and animal cells. Concept mapping is used to illustrate biology topics in graphical manner. The functions and structures are in an ample amount in biology, where students might get confused between two similar kinds of concepts. Therefore, teachers use concept mapping to make the students learn about different aspects and accomplish deep understanding of the elements they want students to learn [15].

**Laboratory:**
Biology is among those practical courses where students are taught about the many techniques used in biology. These laboratory classes are developed based on the lecture, to enhance the understanding of the students by practical demonstration. The educators, in such a session, usually offer short introduction to the lecture and the contents of a certain laboratory session. Practical materials are provided for students to work with, and then they compile their practical reports, and ask few questions. The teacher, in turn, answers their queries and checks practical journals. Students in a laboratory session, sometimes, work as a groups or pairs of two. Normally, the students are also required to appear in practical examination that carries 10-15% of the total marks at the end of year/semester [15].

The laboratory practices are sometimes used ineffectively. According to Ataman and Emine [16], it is because students are not given required time to stimulate their minds and acquire enhanced knowledge being taught in the laboratory setting. Another reason is that the conformation techniques that are applied in laboratory practices, are usually targeted towards improving the low-degree mental capabilities which includes algorithm issues, and memorization by heart. The education of science does not imply that knowledge is transferred, only, but it also requires that critical skills are acquired and polished so that problems can be solved and creativity prevails. These developments of skills are less likely to be accomplished by traditional method of teaching [17].

There is a need for better and enhanced communication among students and teachers for better understanding of biology and its application to real life [18]. The lack of communication among student-teacher is creating crisis situation in biology education since students are less motivated and increasingly, a smaller number of graduates prefer to be science majors. The traditional learning method, including the above-mentioned approaches such as lectures and laboratory work is teacher-oriented. It has flaws, which are penetrating deep into the education of biology. When teachers adopt active-role and the students are in passive-learner role, some students are too shy or anxious to ask question in front of the whole class. Although many contemporary teaching approaches exist, their impact is questionable: the lack of research calls for great measures [15]. This paper proposes cooperative learning to teach biology where the main focus would be on cell biology. Cooperative learning lesson plan and strategy would be explored; thus, it is necessary to understand the research based on the essentials of cooperative learning.

**The Concept of Cooperative Learning**
Slavin [19] states that an instructional program which help each other in grabbing the knowledge of the educational contents by working together in form of a group is called a cooperative learning group. In simple terms, cooperative learning can be defined as combined effort and steps taken to solve an issue. For any kind of given work, in collaborative learning, the students are required to come and work together. It is among the teaching techniques in which groups are made, where different students have different level of abilities: in this technique different learning activities are used to make students increase their understanding and gain knowledge [4].

Although collaborative learning and cooperative learning tend to be similar to one another, there are quite different. The main distinguishing feature is that in cooperation, the main purpose is to reach to an end product or to a cause through which people work with one another. On the other hand, the collaboration includes individual effort while respecting each other’s work and collaboration towards same cause or end product. It can be simply said that collaboration requires individual efforts contributing to the same cause, whereas cooperative technique requires interaction among the group members working as a team using a structure of interaction [8].

The authors Zakaria and Iksan [20] states that: when students work with another using cooperative learning, the effectiveness of learning is enhanced. A study by Cavanagh [21] described the opportunities that can be created by engaging students in cooperative learning lectures and activities. The open interaction in cooperative learning is very useful since students interact with one another, share their ideas, and learn from one another’s experiences and learning: clarity in their understanding is acquired and they also tend to construct new ideas. The study by Toumasis [22] explored the effects cooperative
learning has on 10th graders where the ability to comprehend mathematical course book was investigated. It was found that students were able to make new friends and they also learned to work in cooperative environments where they appreciated the difference of opinions, the differences of skills abilities and the difference among one another in general [8].

The Benefits and Considerations

The benefits and impacts of cooperative learning are globally known and praised by researchers, educators and scholars [23]. The first advantage is the social interaction that is achieved by cooperative learning only. Individualistic learning has a number of benefits but it lacks social interaction that is gained by group work only. When students work together, and conduct face-to-face interaction, their insecurities and anxieties are sorted. As per one study, a student confessed that asking question is much easier when it’s in front of some students in a group rather than the whole class [6].

Another benefit is that students tend to learn from each other since cooperative learning helps in transferring ideas. In a group work, students work with one another and share their thought process that helps in promoting improved learning. The student who is the best achiever and knowledgeable shares his opinions that is useful to other team members who might not be able to comprehend it otherwise. In this way, the learning process is fastened because students do not compete with one another, rather, they make sure that each group member is doing their best. It is because they realize that they are stakeholders in each other’s success [4].

Another advantage is that students learn and acquire leadership skills. In cooperative learning group, each member is accountable for their own work and other students’ work as well. The group work requires that each student work on time and also makes sure that others are also doing this contribution timely which stimulates leadership skills in them. The individual learning is different in this aspect because leadership is held accountable to one person if a group is made. On the other hand, in cooperative learning, each member of the group is held accountable to monitor their part of work. Thus, the benefits in this area includes: enhancing social skills, building and regulating leadership skills, and easy transfer of useful ideas among students [4].

Considerations of Cooperative Learning

Although there are many benefits of cooperative learning, it is necessary to make sure that correct approach has been applied: especially right type of cooperative learning group is made based on the material assigned; otherwise, there might be negative consequences of applying group-work setting using cooperative learning. Some considerations include that; educators must use correct dynamics, and correct groups should be made for the suitable lesson plan, if cooperative groups are made for false kind of lesson, then consequences can be severe for both teachers and students. The teachers face hardship in managing the groups due to mixed dynamics in the group and diversity as well. Some teachers might find it hard to manage the team members and their issues. For instance, stronger students may complain that low-scoring students are slow and they held the functioning of the group task thus things are not being timely completed.

Some slower or low-achieving students might as well complain that they feel overshadowed and ignored by the high achievers or knowledgeable students in the team [4].

These issues might seem complex, but trained and capable educators tend to deal with these problems with wisdom and grace. Therefore, teachers must also work on their abilities and polish their skills to manage the cooperative learning groups effectively. Turning back to traditional methods of teaching, as some educators might choose, will not do any good to the students or the teacher [24]. Contrary to this consideration, the benefits are an ample amount and therefore cooperative learning is very useful and an effective teaching tool which should be applied to current crisis in education especially biology and other science studies [4].

The Fundamentals of Cooperative Learning:

As stated by Johnson [25], cooperative learning is referred to as a tool that is used by students in the shape of small groups such that group and individual learning is enhanced. It is necessary to differentiate among cooperative learning, competitive learning and individualistic learning. The competitive learning is the one in which students work independently without working in groups. In competitive learning, the students like individualistic learning, work independently but they are targeted to perform better than other classmates. In cooperative learning, on the other hand, the students’ work together without worrying about competing with one another towards achieving a common learning goal. The cooperative learning can be applied to any task, curriculum, age, etc. There are three types of cooperative learning or there are three ways in which cooperative learning can be applied [26].

Formal Cooperative Learning: This type of group in cooperative learning typically lasts from one class to few weeks as much as is needed for a course to be completed, to solve complex issues, writing research papers, reports or a project etc. According to Johnson and Johnson [27], it is best effective in projects that have longer timelines. In this type of cooperative learning, the teacher arranges students in small groups and they are assigned a task, and are provided with the required resources necessary for the completion of a task or activity. A group can have anywhere between two to five students [4]. The task is given; concepts and procedures are explained to them. After which students are expected to work on the given task with the help of each other’s abilities. The students’ work with each other systematically while the teacher monitors them and intervenes only when students require additional understanding. When the task is completed, the teacher evaluates the assignment based on individual abilities, as well as group participation. Thus, students are stakeholders of each other’s success and learning [4,26].

Informal Cooperative Learning: This type of group learning is not long lasting; they are temporarily made by teachers to last one class or just few minutes and sometimes during a class. This is used by teachers to make students understand some phenomenon, demonstrate a concept, set the mood, or make an impression on the class about what is going to be taught etc. There can be several purposes for making such types of cooperative learning groups. As stated by Cloud [4], informal cooperative learning is best suitable for tasks that require small
amounts of time to be completed. The material is not much longer such that it can be summed up in one period. Informal cooperative learning tends to be beneficial for both students and well as teachers in such cases [4].

Cooperative Base groups: These types of cooperative learning groups are rather long lasting and long term, such that these can last up to a semester or for a year. The purposes behind making this type of groups can be many based on the requirement such as learning, motivating one another, helping in improving outcomes etc.; the cooperative learning base groups are quite harder and complex to be created [26]. Such types of groups are made earlier in the study term, so students can help one another throughout their upcoming classes and courses [27]. Base groups are beneficial in determining and monitoring the developmental phases of students throughout their association on different subjects like math. The educators should use this type of cooperative learning taking into consideration the assignment [4].

In order to implement cooperative learning, it is important that students are divided into groups. Researchers agree on the effectiveness of cooperative learning in education, but there is a debate regarding the size. Some researchers agree that the size should be anywhere between 2 to 6 students in a group. The size of the group might depend on nature of the task or goal that is to be accomplished by the students. The construction of a group can be done on random basis, sometimes teachers allow students to make their own choice of group, however research suggests that it is better and effective when teacher makes a group that is rationally assorted. Other researchers recommend that groups must have diversity in terms of gender, ethnicity, and race etc [4, 5].

According to Davis [5], the formal learning cooperative groups must be made considering the academic background and interests of students, their ability and style. In cooperative learning, when groups are successfully made, the students are assigned different roles to contribute to the functioning of the group. The roles are typically of three categories such as social, academic and group processing. Johnson and Johnson [28] claims that it is better that the roles of students in group should be interconnected to one another in a fashion that they complement each other’s roles [26]. There are many definitions of cooperative learning, and the concept of cooperative learning is broad. However, there is one suitable and reliable definition by David and Roger as cited in [29] as per their model that cooperative learning can be achieved if the following elements are present and students are distributed in groups.

Positive Interdependence: It means that the students in a group understands that they need to work with each other in order to achieve their goals, they realize that they are the stakeholders of each other’s learning and they will have to bear the losses together [30]. Thus, teachers must develop lesson plan in a way that students would realize that they either fail or pass together. They would know that their success of an assignment depends on one another, if one student gets a zero on his part all of them will fail as a team. This way, they will be clustered to one another and depend on each other for achieving success and polishing their learning skills [31].

Sense of Accountability: It means that all team members must remain accountable for the work they do and the skills they are to acquire in order to fulfill their assigned roles [30]. The reason for selecting cooperative learning as teaching method for educators is to ensure that students achieve high success which might not be achieved if they learn individually. Accordingly, even in cooperative learning group, each member is held accountable to complete their portion of assignment, and learning the assigned topic. The teacher evaluates every member of the team individually and with group work as well [31].

Face-to-Face interaction: It means that it is possible that some of the students prefer a section of the assignment to be done individually at home but it is necessary that some of the work is done interactively and the students must interact face-to-face and share their ideas [30, 31].

Using Collaborative Skills: in such environment students are expected to help each other by building healthy relationships with one another to facilitate the decision-making tasks, and resolve conflicts. It also polishes communication skills of students since they interact and share ideas with one another as well as work as a team [30]. The teacher would explain to the students how they can work together and use their collaborative skills to resolve conflict, appreciate each other’s opinions, provide critical feedback to one another and negotiate their roles. Just because a group of students are placed in cooperative learning culture, it is not wise to expect them to automatically fulfill their assigned roles: teachers would have to make them understand how exactly they can work together collaboratively and cooperatively [31, 32].

Processing of Groups: The goals are unified, this implies that, the students make goals as a team rather than making and concentrating on individual goals. They make sure that each and every member of the group understands the goal and accomplish it successfully. Meanwhile, they monitor each other closely, and determine changes or modification that might be necessary in order for the group members to function effectively [30]. The groups must be heterogeneous: students choosing their group-mates based on friendship, or that stronger student make their groups are a practice that would go against the basic purpose of making cooperative groups [31].

WHY CHOOSE COOPERATIVE LEARNING?

Cooperative learning may seem simple and easy but it is not. There are benefits which make cooperative learning better than individual learning. There are many reasons which may contribute to the selection of cooperative learning as the best suitable and effective teaching approach. Research and educators both believes on the idea that students are able to learn smartly, by practicing and being actively involved rather than just by sitting and listening to the lesson traditionally prepared by teachers. The cooperative learning has the most important attribute i.e., engaging student in active learning exercises and participation. In addition to that, cooperative learning provides benefits in ways that can be used as remedies to traditional teaching such as competitive and individualistic learning [30].

In cooperative learning, for instance, weak students would not give up because of the de-motivation they have
to suffer each time they see their names at the end of their class list. The weak students work cooperatively and learn from one another and this lets them keep going without giving up. The strong students, on the other hand, usually take the role of explaining and describing the given material to all team members where, weaker students would gain better clarity while the stronger student would fill the gaps in his/her knowledge while explaining to them. Other reason why cooperative is better than competitive learning or individual learning is that, when students learn individually there are chances that they would face delays and they might even skip assignments than when working cooperatively [4]. Students realize that others are also depending on their work and thus they work with motivation and extra effort to cope with the team expectations [30]. The research suggests that there are several aspects of cooperative learning which can be beneficial in the education of cell biology. Different teaching approaches can be used to accomplish the goal of education. This paper will solve the problem of cell biology education by implementing cooperative learning strategy.

3. Research Methods

The problem of biology teaching can be solved in many ways that are different from traditional learning. The traditional learning does not involve students in active learning, thus the effectiveness of traditional methods of teachings are not admirable. The novel methods and teaching approaches that are currently being used in existing education system includes concept mapping, group learning, and methods in which students are actively involved in the learning process. The educators are looking for ways in which students can be positively included in the learning participation so that they learn and discuss with each other, share ideas, stimulate their minds, and find gaps in their knowledge [4].

The concept mapping technique is also highly preferred by most researchers and scholars. The concept mapping works by illustrating the contents to be learned in a graphical manner. Teachers nowadays use concept mapping to differentiate among animal and plant cells. It is easier to learn this way since students get an idea of what is similar and different among the two types of cells. The concept mapping has its benefits but there are flaws as well: the implementation comes with considerations on the educator’s part. If implemented correctly, the students can benefit from this technique; however, it is not feasible for all topics to be illustrated by concept mapping [16,33].

This paper is using the cooperative learning strategy to solve the problems of cell biology education. As per literature review, there exists a wide range of studies and researches that support the effectiveness of cooperative learning technique in biology classrooms. The approach is beneficial in many ways and dramatically different from traditional learning method because it challenges students to learn actively in the classroom rather than sit like a passive learner. There are many types of cooperative learning which can be used by teachers in the biology classroom. The crucial element that must be present in a cooperative learning group remains the same, however, the techniques have few moderations. The cooperative learning strategy which I am proposing to be used in solving problem related to teaching of cell biology education is the jigsaw cooperative learning technique [16].

The Jigsaw Technique

The Jigsaw technique has been used by many educators and most educational systems are benefiting from this approach towards teaching, however, there are also some who argue against its effectiveness and the complexity which is not easily followed by every educator [30]. In a Jigsaw approach, students are divided into small groups where each group may have 4-6 members. The material and resources are provided by the teachers; the learning objectives are also clearly explained. The content is divided into small chunks that can be equally distributed among the members of the group. The teacher makes sure that each group understands the learning goals. In addition to that, the teachers also ensure the management of groups. The groups should be heterogeneous: meaning it must be diverse in terms of race, ability, gender etc. Another group, such as expert group, is made from using members of jigsaw groups that have similar contents assigned to them [33].

The Jigsaw approach is implemented by making two groups such as jigsaw group and experts’ group. The jigsaw group will have 5 students such as from A to E and the experts’ group will have students having same contents assigned to them i.e., 5a, 5b, 5c, to 5e. The experts’ group is made so that the students having similar content assigned to them prepare their idea of the content interpretation and discuss it to one another. This is where students interact with one another sharing their part, and learning different perspective on the similar content by viewing other’s work. In this phase students gain clarity and fill the gaps in their knowledge. The experts’ group is made so that students become experts and prepare for peer-tutoring other students in their jigsaw group. After that, these experts are returned to their jigsaw group and present their prepared material to them, tutor them about it so that all of them can study the material [34].

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All of the students will be distributed in small groups of 5 members. The teacher will make the groups and ensure that the essential components of cooperative learning are present. As recommended by Johnson and Johnson [26], the essential elements include: positive interdependence, smooth processing of groups, and accountability on individual members, face to face interaction and development of social skills. In addition to these elements, the teacher would also make sure that the groups are heterogeneous. It means that the group has members that are of different genders, high-low achievers, different races and backgrounds. The diversity is a must for cooperative learning groups otherwise the effectiveness may get compromised and outcomes would be unwanted [4,34].

Step-by-Step Implementation

Step 1: Getting Started: The educator will ask students of the entire class to make groups of five students. The educator will ensure that the group is diverse and heterogeneous in terms of abilities and race/gender etc.
This can be accomplished in two ways either students make groups themselves, or the educators can intervene and select one or two group members to ensure that heterogeneous groups are made. It is thought that it is better that teachers select group member of each cooperative-jigsaw group rather than relying on the students. However, several researches have opted for student-dependent cooperative groups in which conditions are clearly mentioned by teachers to students for instance, there cannot be two high-score achieving students in the same group.

**Step 2: Interaction:** The group members will be seated in a fashion that they face each other. It is achieved by placing students in a rounded manner like they are conducting a round-table meeting. This practice will help students in increasing their social and communication skills while they build trustworthy relationship among each other.

**Step 3: Information:** In this step, the teacher will take responsibility to make students understand the learning goals and objectives. As the chosen content for this paper is cell biology, the teacher will provide a brief introduction of "what is a cell?" After that, the teacher will educate the learners about the lesson plan. The objective of this lesson plan is to learn about the cell and its parts. The structure of the cell and its functions will be demonstrated.

**Step 4: Materials:** All the created jigsaw groups will be assigned alphabets to distinguish among them such as from A-Z based on the number of 5-member groups. In this stage, the educator will inform the students about the instructional material and resources they should access to learn about their assigned content and prepare presentation. Based on the topic chosen, the inside of a cell will be divided in 10 major parts as follows; the related material will be given to all students. These will be notes, photocopies of relative readings, lecture slides, handouts about the content etc.:

1. Cytoskeleton
2. Cell Wall and Cell Membrane
3. Nucleus
4. Ribosome’s
5. Rough Endoplasmic Reticulum and Smooth Endoplasmic Reticulum
6. Golgi Apparatus
7. Lysosomes and Vacuoles
8. Mitochondria
9. Chloroplast
10. Cilia

**Step 5: Roles:** The teacher will assign roles to each student in a group. This can be done by students themselves, however, it is better if the teacher decides on roles for each student in groups. The roles can be for instance, summarizer, researcher, observer etc.

**Step 6: Explanation of the Activity:** The teacher will explain to the students about what is expected of them. The topic is regarding the parts inside a cell, the organelle, and their functions. The learners will be informed that at the end of the lesson plan completion, they will be taking a test which will assess their learning level.

**Step 7: Emphasis on the Elements of Cooperative Learning Groups:** The teacher will describe the major elements of cooperative learning group and explain why all these elements are necessary and what effect it may have on their assessment and scores. The following are essential elements of cooperative groups and how they can be achieved:

1. **Positive Interdependence:** This means that the lesson plan must be designed in a way that students in a group must have to rely upon each other for learning. This will be achieved by distributing the contents evenly among 5 students in a group. Since I have chosen structures and functions of a cell and its inside, the content will be divided into chunks as follows.

2. **Individual Accountability:** The teachers will explain to the students that they are to work in a group, however, they hold the responsibility and accountability of their part of work. For instance, a group member who has been assigned to learn about the cell wall, cell membrane structure and function in a cell, must learn about it fully because he/she will be responsible for his/her understanding of the content, and the peer tutoring he will provide to other students in next stage.

3. **Social Skills:** The students will learn from one another, and this is also one of the best benefits of cooperative learning. They develop relationships with one another, and interact socially which reduces their anxieties and stimulate confidence in them. The cooperative learning is specifically designed to enhance social capabilities, communication skills, critical feedback etc.

4. **Face-to-Face Interaction:** The face-to-face interaction is implemented in cooperative learning groups by placing the students in a fashion that they face each other directly. This increases clarity, enhances interaction among all team members.

**Step 8: Required Behavior and Criteria:** The teachers will explain to the students that they must incorporate cooperation and collaboration in their roles towards the group. Their required behavior such as cooperation is necessary. The teacher will explain that they must work with their team members in jigsaw and experts’ group, rather than competing against one another, the students’ work for the group and they help each other. The high achieving student will be educated by the teacher that he/she must not refrain from helping other students. On the other hand, the low achieving student will also be motivated to ask his/her group members to help him in learning. The criteria for success and completion of assignment will also be clearly explained by the teacher which is that students must work with each other. Other students will be relying on the peer-tutoring and thus the students must understand that their actions would have consequences. This might also create a sense of responsibility in students that they must give their best.

**Step 9: Intervention and Monitoring:** The teacher will initially play the role of active monitor; he/she will monitor the students without intervening and let them participate and learn. However, the teacher will intervene in situations if the groups are not being well managed. For instance, there could be students who might not cooperate with other group members. In that case, other group members might complain to the teacher and if, after a warning, the student does not still corporate, then such a
student can be expelled from the group. Conversely, if a student is active and good in cooperating but other group members are not, such a student can also resign from a group after discussing his/situation with the teacher.

**Step 10: Transition from Jigsaw to Expert Group:** After successful jigsaw groups are made and contents are assigned to group members, an example of group has been shown in Table 1 in Appendix A. After that, the students having same topics from all groups will compose an expert group and they all will learn their contents fully by filling all the gaps in their knowledge, and clearing all the misunderstandings. In this stage, in the expert group, students will prepare themselves for peer tutoring. Once they master their content and prepare presentations, they will return to their initial group, the jigsaw group and relay the teaching to members of the jigsaw group. All other students will make notes, ask questions and learn about other parts that are not assigned to them but are peer-tutored to them by their own group members; this way students work with one another and ask questions without hesitating. At the end, all students are assessed by the teacher through a quiz that carries questions regarding the whole content. In cell biology; all 10 contents will be included in the test taken by all students to measure their level of understanding.

| Each group will have 5 members as follows | Assigning Alphabets to each student | Distributing contents |
|------------------------------------------|-------------------------------------|-----------------------|
| 1 A                                      | a) Cytoskeleton                     | b) Cell Wall and Cell Membrane |
| 2 B                                      | c) Nucleus                          | d) Ribosome            |
| 3 C                                      | e) Rough/Smooth Endoplasmic Reticulum | f) Golgi Apparatus     |
| 4 D                                      | g) Lysosomes and Vacuoles           | h) Mitochondria        |
| 5 E                                      | i) Chloroplast                      | j) Cilia               |

4. Discussion of Findings

It is among the crucial elements of society to survive in cooperative environment since people work together for the best of all. Societies can best survive when individuals work collaboratively for the same cause. Traditional methods of teaching stimulate competition in individuals rather than cooperation. The background studies and research on the effectiveness of competitive individual learning reveal several issues. A wide range of research suggests that traditional teaching has negative elements to it. In traditional teaching, students work in a competitive environment; they work against each other to earn recognition. The major negative effect is on the classroom environment where higher achievers do not make an effort because they know they will be among the toppers anyways, this adversely affects the low-scoring students because they feel de-motivated and tend to withdraw from such an environment which they do not want to be a part of [8].

5. Conclusion

This paper visited the problem of teaching cell biology to students. The terminologies and the nature of the content in cell biology are quite difficult for students to understand at a glance. For this reason, cooperative learning strategy was chosen to influence the learning process in students; the cooperative groups are helpful for students in many ways. The cooperative learning solves the problems in cell biology education because it provides students with opportunity to work with one another rather than competing against each other. When students compete against each other, they hide their technique of learning and understanding because they are in a competition with one another. This nature of traditional teaching sometimes works against the best of students, because higher achievers might not work harder since they know that they will be in the top list anyway. On the other hand, the low achieving students might get de-motivated and withdraw altogether.

6. Recommendation

There are some considerations necessary to be taken by educators when implementing the cooperative learning strategy; the group management, and the essential components of cooperative learning groups must be present. Otherwise, the outcomes might not be desiring and satisfactory. The benefits of cooperative learning are many, which overshadows its side effects and thus, this technique of teaching cell biology to students is preferred. This technique does not only make the learning process fun, enjoyable and easier, it also polishes skills that students will benefit from all their lives.

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