

Title: Creative thinking in the classroom

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**Abstract**

This study sought to find the difference in teaching techniques for creative thinking strategies between reading and biology classes at the undergraduate level. I selected undergrad students in the College of Education at the University of Southern Indiana and a random sample of 38 students, 19 in each class from 18 years or older. This study collected the information by observation for each class and was conducted over three days. Also, I had an interview with two faculty members and a survey with students. The study found there are no specific techniques to use by the teacher in the classroom with students to develop creative thinking among students, but that creative thinking techniques come on due to the capacity of the teacher and his experiences in teaching. Although there is no curriculum with adequate space for the development of creative thinking skills, the professors tried to use more materials outside of the curriculum to help students to be more creative. A number of recommendations will be presented in light of the results.

**Key Words:** Creative, Thinking, Teaching.

Title: Creative thinking in the classroom

When I was working as a social worker in El-Manart School in Saudi Arabia for two years, I noticed that some students were able to think creatively by asking questions outside the textbooks, but unfortunately, the teachers did not provide additional incentives and support for the particular students who seemed to develop special skills. In an attempt to discuss this important matter with my colleagues at school and my family members, who also teach in different schools and at different school levels, I realized that no one was interested in developing that area with students, being focused and sometimes overwhelmed with the basic and mandatory lessons provided to students every year. Once, a fellow teacher said, "I do not have more time to give attention to help students to think creatively in the classroom because I have too many things to do in the classroom with my students."

This was very different from when I studied in a class called "Thinking in the Classroom." He gave me and the other students in the classroom a set of questions concerning a general problem, and he asked us to think about innovative solutions to the problem. He wanted us to provide unusual answers to the questions, while soft music played in the background of the classroom for about one hour. After an hour, he asked us to start an open discussion in class where we shared our own answers for each question by exchanging thoughts and ideas. I enjoyed this type of discussion to the maximum because it opened the discussion to different routes of thinking; it gave us the incentive to get outside of our own ideas and to be exposed to other ideas provided by colleagues. Creative thinking in this way helped us by organizing our thoughts and classifying them in steps arranged by priority order, which was a beneficial and critical tool that I learned from this class. In fact, I quickly noticed that this class was different from the others as it was my first class that encouraged me to think differently and creatively while sharing and

grasping hundreds of ideas and other different and creative ways of thinking. I wish that similar classes were offered more often in every program of study, and supplementary advanced classes should be offered to outstanding students, with special skills, who need the right tools to develop them further.

I selected this topic of research for many reasons, most importantly, due to my own belief that human beings are distinguished from other creatures by their own functional brain and ability to think, create, produce and benefit the new generations and the entire society. I strongly believe that without creative thinking development, students' performance in basic classes may decline. Furthermore, creative thinking development would help students not only to achieve success in all educational levels from kindergarten to graduate level, but also would help students to pursue successful careers in the future by being distinguished amongst others by their outstanding performance and creative discipline in their field. In addition, the teacher could gain a better understanding about creative thinking strategies and with which students to use these strategies in the classroom.

The purpose of my research is to explore this question: what is the difference in teaching techniques for creative thinking strategies between reading and biology classes at the undergraduate level? I chose this question to explore whether the teacher can use the same strategies to develop creative thinking in every classroom or if every class should have its own individualized strategies to use with its students.

My "Thinking in the Classroom" class inspired me to focus on these sub questions:

- Are instructors aware of the importance of creative thinking?
- Do students understand the meaning of creative thinking?

- What are the methods used by instructors, at the university setting, to develop students' creative thinking?
- Do class curricula help students to develop their creative thinking?
- Does the classroom environment help students to develop their creative thinking?
- In addition to textbooks, are there activities provided in the classroom that help students to develop their creative thinking?

To find the answers to these questions, I observed two different undergraduate classes, observed the behavior of the professors and training methods provided about creative thinking and how to work with students to develop creativity. I used a checklist (See Appendix A) about each professor's use of traditional methods based on lecture and recitation and how he/she developed his/her ideas. Also, I conducted an interview (See Appendix B) with the selected two faculty members and conducted a survey questionnaire (See Appendix C) with the students of these two classes.

This study could enable teaching practitioners to understand what is required in the classroom and clarify any misconceptions, embedding creativity in classroom practice, and considering whether this area is being met by teachers – and to what degree. This is the rationale behind this study: to learn more about how practicing teachers respond to creativity, to examine changes in teachers' attitudes toward creativity, and determine if students acknowledge creative teaching and learning positively. This knowledge could assist policy makers, in USA and especially in my country of origin, Saudi Arabia, so that improvements, training or changes can be made by teacher educators or by continuing professional development courses for teachers.

### **Literature Review**

Creative thinking is a technique for observing problems or situations that suggests unusual solutions (which may look unsettling at first). Creative thinking may be stimulated both by an unstructured process, such as brainstorming, and by a structured process, such as lateral thinking.

Having reviewed some of the most recent theoretical approaches in the study of creativity, I wanted to compare teaching strategies at the undergraduate level, the behavior of the professors and training methods provided about creative thinking and how to help students to develop creativity. Some students have the ability to think creatively by asking questions outside the textbooks, but unfortunately the school may not provide additional incentives and support for these particular students who seem to develop special skills. In an attempt to discuss this important matter, I noticed that few teachers are interested in developing that area with students, being focused and sometimes overwhelmed with the basic and mandatory lessons provided to students every year.

Dugosh & Paulus (2000) say that creative thinking plays a crucial role since students presented with more ideas in turn produce additional ideas. The creative thinking thus provides a clear methodology to introduce students to advanced concepts. The main thing a teacher must do is ask questions with multiple correct responses. Karpicke & Roediger (2013) stress the need for infusing creative thinking into the undergraduate degree curriculum as an effective way for data retrieval. The data retrieval occurs in the memory and involves retrieving learned information using creative thinking techniques. However, there are fundamental differences in the creative thinking strategies for teaching biology and reading classes at the undergraduate level. One can group these teaching methods according to six main concepts relating to cognition, the making of

connections, pedagogical teaching techniques, and creativity obtained from content knowledge, adaptive expertise, and amplification of creativity through collaborative thinking.

Kaufman & Sternberg (2010) say that the creativity phenomenon and the use of creative thinking to teach Eurocentric languages like English involve multiple interpretations. One can derive multiple conclusions and contexts from a single sentence as a result of the mind's ability to look for subtle sub contexts or hidden meanings. Thus, only narrow creativity aspects are comprehensible in terms of verifiable hypotheses that provide concrete "Yes" or "No" answers, that is, definite losers or winners. The paper will look at these concepts and discuss fundamental differences between the teaching methods used in undergraduate biology and English language instruction.

Cognition refers to the unique set of an individual's mental processes and abilities that are related to various skills. These include general memory, attention, judgment, evaluation, problem solving, and production of language, comprehension, decision making, computation, reasoning, and working memory. Cognition in human beings can occur in an abstract or concrete manner, consciously or unconsciously, and intuitively (for example the knowledge of a language). Cognition can also occur conceptually (the model of a language for example). Carter (2004) says that cognitive processes tend to use existing knowledge to generate a new set of knowledge. One can analyze cognitive processes from various perspectives within multiple contexts. This includes the fields of anesthesia, linguistics, computer science, systemic, biology, anthropology, philosophy, psychology, psychiatry and neuroscience. Carter (2004) says that one could synthesize other different approaches to the condition through developing fields such as cognitive science. Also, Beyer (1997) says that within philosophy and psychology, the cognition concept is related to various abstract concepts such as intelligence and mind and encompasses

mental processes, thoughts, mental functions, and intelligent entity states. Examples of this intelligent entity state include collaborative groups, humans, artificial intelligence, highly autonomous machines and human organizations. Costa (1991) says that cognition can also refer to the information-processing model of a person's psychological function. Also, he says that social cognition can explain group dynamics, attribution, attributes.

One can summarize this by saying cognition is information processing in an individual's brain or mind that can exist in an artificial form when abstract and specific. As mentioned earlier, cognitive processes use existing knowledge to generate new sets of knowledge. Therefore, cognition would play a role in the teaching of undergraduate biology using creative thinking techniques rather than the English language since the knowledge already exists. Kokkidou & Willingham (2013) say that creative thinking makes it easier for undergraduate students to successfully apply the lessons they learned to come up with solutions for problems. These problems in varied situations are different and thus pose a challenge compared to situations involving learned information. The authors give the example of mathematical problems and those requiring creative thought. Mathematical problems require the application of standard equations to get a result. Thus if someone says that they bought 10 apples at a dollar each and ten oranges at 50 cents each, one would need to apply mathematical principles of addition and multiplication to get the correct result. The result would of course be multiplying the number of fruits by its individual cost then adding the two disparate items together.

Lau (2011) says that people with high cognitive functioning also tend to possess significantly more creativity than average individuals. The author gives the example of great thinkers like Da Vinci, who already had existing knowledge. Da Vinci had the ability to come up with abstract concepts through cognition because his knowledge was in several areas, including



physics, biology and art. His knowledge and his ability to think creatively ensured that he could think creatively and come up with inventions that nobody else had built. Eragamreddy (2010) acknowledges that creative thinking can work in languages, but only when teaching those who have a limited command of the language; Lau (2011) says that creative thinking involves conjuring up multiple scenarios while having a template of an existing item. For biology students, creative thinking would thus work best for those with higher cognition. Someone with higher cognition could use various scientific and social aspects to come up with a solution. Kim (2012) gives the example of a teacher instructing pupils on the workings of plant cells. The teacher would have to talk about the molecules in the cells and what each of them does. If students do not comprehend, the teacher could tell the students to think of the molecules in terms of pupils and the cells in terms of classes. Every individual molecule acts like a student in the class, moving and absorbing things.

The collective effort of the molecules results in a unified unit called a classroom that can impart knowledge. Several classes make a school, and one school could represent a certain system in a plant such as the root or leaf system. Kim goes on to say that if one combines the systems or classes, they get an entire "structure" called education. In this case, the system called education represents one whole tree or plant. Adair (2007) says that since cognitive processes involve problem-solving, reasoning and working memory, they would apply in creative thinking techniques for teaching undergraduate level biology. Biology at this level requires the student to both memorize facts and reason how various systems relate to and work with each other in an organism. Someone with the ability to think creatively could come up with formulas or patterns to explain how something works or how it formed within an organism. Mursky (1975) uses the example of patterns to explain the flow of blood through the heart's arteries, veins, and

ventricles. A creative thinker could come up with abbreviations such as PA, PV, RV, LV Art, OB and LG. The abbreviations mean Pulmonary Artery, Pulmonary Vein, Right Ventricle, Left Ventricle, Aorta, Oxygenated Blood and Lung respectively.

According to Wilks (1995), teaching biology to undergraduate students in a creative thinking setting does not require the making of connections since it is assumed that the students understand the major concepts. For example, students comprehend basic ideas such as cellular functions, the importance of circulation of fluids in the body, and the difference between transport vessels such as veins, arteries, and capillaries. A student at this level can draw from memory a functional human being and outline how the major organs function in relation to each other. A typical student will not need to make any connection between particular systems or think abstractly as the demands of biology are specific. Gerras (2008) says that teachers should encourage students to make or seek new connections between different ideas or even ask the students to provide varied and multiple solutions to problems. The author says this can work well when teaching the English language and gives the example of a typical sentence structure with a noun a verb and an adjective. A student can provide multiple solutions for a single idea by making the noun the subject at the end of the beginning of the sentence.

Bono (1970) gives another example in the context of classical literature. A student studying the role played by King Lear's daughters in the Shakespeare drama will need to make connections between gender and the plot outlined in the account. In addition, one will require creative thinking techniques that make connections when studying other aspects of the English language such as Tautology. Tautology as Bono (1970) says refers to the repetition of an idea or thought using a different sentence structure or explanation. A perfect example would be someone saying the "President of America, who is the leader of his country." In this case, the word

President obviously stands for a leader in the national and international context. Therefore, using President and leader in the same sentence constitutes tautology. Creative thinking can help alleviate this by helping the student visualize the President as a single unique entity at the top of the pyramid. The subordinates, or lower government officials, constitute the bottom of the pyramid. Thus, one can teach the concept of tautology or repetition of words by making the connection between the noun "President" and the pronoun "He". That is, one does not need to use the noun repeatedly, but can use the pronoun instead.

One can use connections when teaching the origins of certain words. For example, both English and German share a near-identical term for possession. The Germans use the word "Habe" for the English "Have". Wakefield (1992) says that one can teach the verb form by making connections to the speech sound. Both the English word and the German equivalent have a nearly identical consonant (b and v). Through making the connection between "B" and "V", teachers can play a major role when teaching the language.

Soliman (2005) talks about creativity obtained from content knowledge supported best when the instructor teaches creative thinking side by side with the subject matter content. That differs from the standalone method which divorces the creative thinking from the content. Solman says this works best when applied to the sciences rather than the humanities, the English language for example.

The author suggests that the sciences are rich in texture and graphics, and so provide the perfect setting for the method. Conversely, one must often think abstractly when teaching the English language. English comprehension provides the best example. Here, an individual reads a passage and then tries to understand the synopsis or plot, the plot twists, the antagonist and protagonist's motives and the moral of the story explains this. The English language requires one

to think how something will unfold because of the vast options possible. The main character could triumph over an opponent or evil could upset the balance of power and triumph over good. Pearn (2006) says that one can teach biological concepts in a creative thinking manner supported by the subject matter because infinite possibilities do not exist. Zabelina & Robinson (2010) say that creative individuals show more flexible cognitive abilities as students and teachers should strive to help their charges develop broader and more flexible cognition. The teachers can do this by providing various opportunities that boost conceptual and informational representations.

Mursky (1975) uses the example of the cellular structure of the plant. This cellular structure does not differ markedly from one plant to the next. That is, there are few variables with the basic foundation remaining intact. Therefore, a teacher can explain something theoretically and then show it practically secure in the knowledge that major discrepancies will not exist. Kaufman & Sternberg (2010) says that the students can relate the physical to the theoretical since no other different possible combinations exist unlike the English language, which depends on complex combinations of rules of syntax and grammar.

French (1992) says that pedagogical teaching methods continue to attract a large measure of positive and negative criticism due to the wide variety of tools and teaching methods used. The writer uses the example of pedagogical teaching methods using multimedia tools such as webcasts, podcasts, smart boards, and interactive computer forums. The author says that when properly applied and with both the student and teacher trained to the appropriate level, they can make teaching. The author says that this applies, especially to the heavily graphical laden sciences. Kim (2012) confirms this, but focuses on the pedagogical methods of teaching the sciences through collaborative project building with the teachers. Kim says that this method can work best when applied to biology rather than the English language because it allows one to see

the building blocks. Davis & Scott (1992) pick up on that theme and expound on it giving the example of a human or animal anatomy. The traditional method of teaching about the human anatomy involves the dissection of cadavers under the supervision of the lab instructor. A pedagogical technique would involve a three-dimensional computer model sectioned to show the various organs and their placement in the body. According to Davis, one could classify this as a pedagogical method suitable for biology because it removes the element of morbidity. Many students would naturally feel apprehensive dissecting any corpse due to the visual and tangible elements.

However, using 3D computer modeling as a pedagogical tool would depersonalize the experience. Carter (2004) makes the same claim about pedagogical techniques that make use of creative thinking. The author says that pedagogical techniques in the sciences, like biology, allow the instructor to control the tempo and mood of the lesson. A competent teacher can slow down the pace of instruction to allow the slow learners to catch up. That would not work when teaching the English language at the undergraduate level due to the lack of concepts. Anyone teaching the language at college level would expect the students to have a fair grasp of the basics such as sentence and verb agreement. It would not be possible to use physical models to explain the position of the verb in relation to the noun or the tenses. Beyer (1997) talks extensively about the pedagogical model as a tool to teach sciences rather than the humanities. The writer says that in Sweden and Norway the use of multimedia and relaxed formality makes this possible. For example, Swedish undergraduate biology majors can join interactive web forums where they can ask questions. Their teachers can also join the forums and interact with their charges. The forums are linked to online academic resources that the students can access and get information. Once they get this information, the students could countercheck every fact for authenticity.

Beyer (1997) says that this cannot work with undergraduate English level teaching due to the broad manner in which one can interpret phrases or expressions. Wilks (1995) weighs in on this by saying that the pedagogical method allows students to set their goals guided by the philosophical beliefs of the teacher. The teacher instructing an undergraduate biology student teaches in a manner that takes into account the student's relative immaturity and limited factual knowledge. The teacher then uses the pedagogical method to guide the student into achieving the requisite mental and social goals.

Block (1994) says that an adaptive expertise would also work well when teaching the arts rather than the sciences at the undergraduate level. That means one could better use this expertise when teaching the English language rather than Biology. The broad construct called adaptive expertise encompasses a wide-ranging personality related components, motivational, dispositions, habits of mind, and cognitive components. The English language has many rules and regulations that one must follow to communicate coherently. For example, the subject must "agree" with the verb and one must use the correct tenses when indicating time. The speaker must also use the correct gender when referring to people or animals or using pronouns. Block (1994) says that one cannot just mix and match because specific rules exist. The specific rules also result in English speakers developing certain specific problem-solving skills.

Block (1994) says that these problem-solving skills come in handy when comprehending passages in books or trying to understand complex literature like William Shakespeare's works. Parnes & Harding (1962) give the examples using books used to teach literature like "A Random Walk Down Wall Street" by Burton Gordon Malkiel. The book combines economics with English literature, anthropology, and sociology. For someone to teach English using this book, he or she would need to use adaptive expertise to ensure that their students use their unique

dispositions, personalities, and problem-solving skills to understand the text. Block (1994) gives the example of works by the Iranian poet Rumi. His works touch on all themes of life including, love, economic justice, politics, and trade. An undergraduate English student whose course syllabus includes work by the poet would have to use a unique blend of social and intellectual skill to understand the context. Adair (2007) says that one would not need collaborative thinking to come up with a solution for something that can only happen within set parameters.

### **Methodology**

This researcher observed two different undergraduate classes. I observed the behavior of the professors and training methods provided about creative thinking, and I learned how to deal with students to develop creativity. I also used check list (Appendix A) on whether professors used traditional methods based on the lecture and recitation and each developed his/her ideas. Also, an interview (Appendix B) with the selected two faculty members were conducted. During the interviews, qualitative questions were asked to test dependence, integration, motivation, judgment, flexibility, questioning, evaluation, frustration and opportunities. A survey questionnaire (Appendix C) was conducted with the students of these two classes. I used this methodology to find the answer to my research question “What is the difference in teaching techniques for creative thinking strategies between reading and biology classes at the undergraduate level?”

**Participant Group:** The group included two faculty members and a total of 38 undergraduate students. The students were from two different undergraduate classes; one biology class and one reading class. This study included students of both genders; no ethnic background was collected from the study because my research was focused on all races. All students in the two classes

were asked to participate, but the responses were screened to choose students who were 18 or older.

Location: The study took place at a mid-sized university in the Midwest. The interviews with instructors were conducted in their campus offices. Surveys were completed in students' regular classrooms during class time.

My study was explained my study in class and informed consent forms were available for students to sign and participate. I explained to them their right to withdraw at any time during the study. The study was held during the Fall semester 2014; data were collected during three days in October.

Day 1: The first day I introduced myself and, my project to the students. I asked them if they had any questions. Then I sat in the back of the class to begin my observations of two different undergraduate classes (one biology class and one reading class) after obtaining a written approval from the instructors of these classes. I observed the behavior of the professors and training methods provided about creative thinking and how to deal with students to develop creativity using a check list on whether professors use traditional methods based on the lecture and recitation and how to develop his/her ideas.

Day 2: I observed two different undergraduate classes (one biology class and one reading class) after obtaining a written approval from the instructors of these classes. I observed the behavior of the professors and training methods provided about creative thinking and how they dealt with students to develop creativity using a check list on whether professors use traditional methods based on the lecture and recitation and how to develop his/her ideas. (Appendix A)



Day 3: A survey questionnaire was conducted with the students for each class, 19 students in each class, total 38 students. The duration of the survey is about 10 – 15 minutes and it took place in the classroom.

Day 3: I interviewed two professors; a reading instructor and a biology instructor. The interviews were held after class, and each interview was held in the professor's office. During the interviews, qualitative questions were asked to test dependence, integration, motivation, judgment, flexibility, questioning, evaluation frustration and opportunities. The interview took approximately 45 minutes. (Appendix B)

### **Data collection and Data analysis**

This study used a mixed method approach (combining both quantitative and qualitative data). Qualitative data were collected through interviews and questionnaires. I chose to interview the faculty for 45 minutes and students 15 because I thought the faculty would be a good source of ideas. Since I only conducted a small survey with the students, I did not need as much time with them. The quantitative method was obtained from the student survey by giving a score to each question on a scale of 1 to 5 (5 being the highest and 1 being the lowest), then an average score was calculated and collected to analyze the degree of creative thinking for the students in class . The study examined the methods used by instructors in the classroom at the University level to develop the students' creative thinking.

Recruitment: The participants were recruited from two undergraduate classes. Then two faculty members teaching these classes were selected for the study. Permission was obtained from faculty teaching the classes from which students participated in the study. Permissions were taken via email. All participants were from the department of Biology and General Studies at the

University; they were provided with the project outline and signed informed consent forms and were made aware of their right to withdraw at any time during the study.

**Informed Consent Procedure:** The researcher was responsible for obtaining all forms related to informed consent from the participants. The consent form was a typed document that was issued to participants to notify them what the study entailed, potential risks, if any, related to the study, and possible benefits. (Appendix C for informed Consent) The participants were required to understand and sign the consent form prior to beginning the study Fall 2014. In addition, the researcher was responsible for obtaining a written permission (email) from instructors to agree that the selected students could participate in the study.

I asked everyone to turn in the consent form, whether it was signed or not, to the homework tray. They were instructed to turn it upside down so nobody would know if they signed or not. Those who signed the consent were given the survey, while the other students were given a review worksheet.

**Potential risks to participants:** Minimal risk of loss of class time to explain the research strategy and to complete the survey may have occurred occur. Efforts were made to reduce the probability of any risk, such as explaining very well the research strategy to save time in class, and to ensure that all participants were present over this time frame. I saw this as a necessity to make sure that I got the surveys complete and for me to be able to explain the survey. It should not have taken more than ten to fifteen minutes to complete. If students needed additional time, they were allowed to complete it at home.

**Confidentiality and data security:** The names of the participants were coded for confidentiality, and the data were kept in a locked filing in the researcher's home. Data were properly disposed after the content was no longer needed. There was no identifying data that

were discussed about the participants in reporting the results. Any digital data saved on the researcher's computer was deleted following the study.

In order to keep the confidentiality of the data and participants, there was no identifying information system or documents; data were saved in password protected Excel document on the researcher's computer. Any digital data saved on the researcher's computer were deleted following the study. I shredded all of the documents with a cross shredder.

### **Findings**

This study was designed to examine the difference in teaching techniques for creative thinking strategies between reading and biology classes at the undergraduate level. During my observation for the biology and reading classes, I used the checklist (See Appendix A.) to make a comparison between the two classes.

In both classes, the teacher had a great relationship with the students. The reading professor led discussions with students all the time during class. However, the biology professor did not use any specific style of discussion in the classroom. After the completion of the lesson, the reading professor asked the students when would be the most appropriate time to test them. The professor collaborated with the students and made them feel satisfied in the classroom. The reading professor asked the students to write notes on small cards to benefit from them later. For example, the professor required students to study twenty new words every week, and by the end of the week, a quiz will be arranged to test the students about these words and their meanings. The professor asked the students to write each word on a separate card and their meanings on the back of the card.

The reading professor used the computer and the display screen less than the biology professor. Also, the reading professor used the blackboard; for example, before starting class, the

professor wrote a plan on the blackboard of what needed to be done in class for the day and what was required for the next class. The professor also had a file for each student with their names, all corrected homework, duties and activities attached to it. When the student entered the class, she took the file to review it and returned it back at the end of the class. When the class started, the professor checked who did not do the homework and then began reviewing the solutions. On the other hand, the biology professor was trying to use the computer as much as possible to strengthen her explanation of the lesson. After reviewing the previous lesson, the biology professor began explaining a new lesson using graphs on the display screen. The professor focused on the curriculum. He explained the lesson, and the students were listening to him.

The reading professor divided the students into groups, and each group consisted of four students in order to discuss the lesson and work as a team while explaining the lesson. In the reading class, group discussion and exchange of ideas and point of views can be found. In the biology class, however, the students were never divided into groups. The students were only focusing on taking notes from the screen. Unlike the reading professor, the biology professor was teaching to the whole class rather than to smaller groups.

The reading professor was asking questions all the time to make sure that the students understood the lesson. Also, she showed interest in answering the questions of the students and created an informal, conversational classroom environment. The biology professor, on the other hand, asked questions from time to time to be sure that the students understood the lesson, but his more formal lecture style was not as open to conversation. The reading professor was taking the students' suggestions seriously and tried to make them think and be more creative. However, the biology professor did not ask students for their suggestions.

**Interviewing the professors** (See Appendix B.)

The reading professor defined creative thinking as “two levels: upper level as analysis, evaluation and application, and lower level as fundamental thinking skills.” The biology professor defined it as “when students take information they know and think how to apply this knowledge to solve a problem.” Both professors do not recall taking any creative thinking classes, but the reading professor attended some workshops in high school and on campus to use in his teaching strategies. He also has read articles about the best ways to teach. The biology professor attended some seminars that focused on critical thinking. Both professors agree that they have time to apply creative thinking strategies with students. They liked to hear their students’ comments and discuss them together and reach a better understanding.

In the reading class, the professor used more than one technique and curriculum to encourage creativity. One of these techniques was using flashcards, which the students used to write notes about a book they read outside the curriculum and tried to get the main ideas in class to discuss with the other students. The reading professor also used SQ3R strategy – a reading strategy – which stands for: survey, question, read, review, and recite. Another part of the reading class curriculum was for each student to bring his own book to read. They also brought magazines and advertisements and tried to pick the best ones. Students used some imagination to get them out of the classroom in order to make connections to the outside; this made the class more enjoyable and less boring.

On the other hand, the biology professor followed the curriculum, but he liked to engage in an open discussion with his students to be sure that they understood the material. The professor found that another very effective creative thinking strategy that could be used in class was brainstorming. It allowed students to speak their minds and express themselves to come up

with better solutions as a group. The professor also tried to take his students to the lab to use microscopes to see cells, so his students could see with their own eyes what they learned in the classroom. Also, he dissected the animals in front of them and let them participate.

The reading professor said that she did not like to use play as a strategy for teaching students because she thought it was a strategy for high school and lower level students, but she tried to use the other strategies fit with under graduate level, like using flash cards. In addition, the professor liked to give her students four to five different ways to learn, and they are allowed to choose the best way that fits their needs. Unlike the reading professor, the biology professor thought that play could be used as an appropriate teaching strategy for the undergraduate level. The biology professor also said that he adjusts his teaching strategies to fit each class after seeing what works with that group of students.

**Survey students** (See Appendix C.)

It is clear from the survey that the reading professor rewards outstanding students much more than the biology professor. She also helps the students to discover their talent and ability, which means that she helps them improve their creative thinking skills. Moreover, she assigns several activities inside and outside the classroom to expand the students' knowledge and ability to think outside of the box. In both classes, the professors used different teaching methods in the explanations, and they re-explained the lessons in different styles to be sure that all students understood the material and the lesson. They allowed their students to participate in the lesson and encouraged them to think and create. In both classes, students felt equal among themselves in the classroom and agreed that their teachers created the right atmosphere for them in class.

Figure 1: Biology student responses to questions

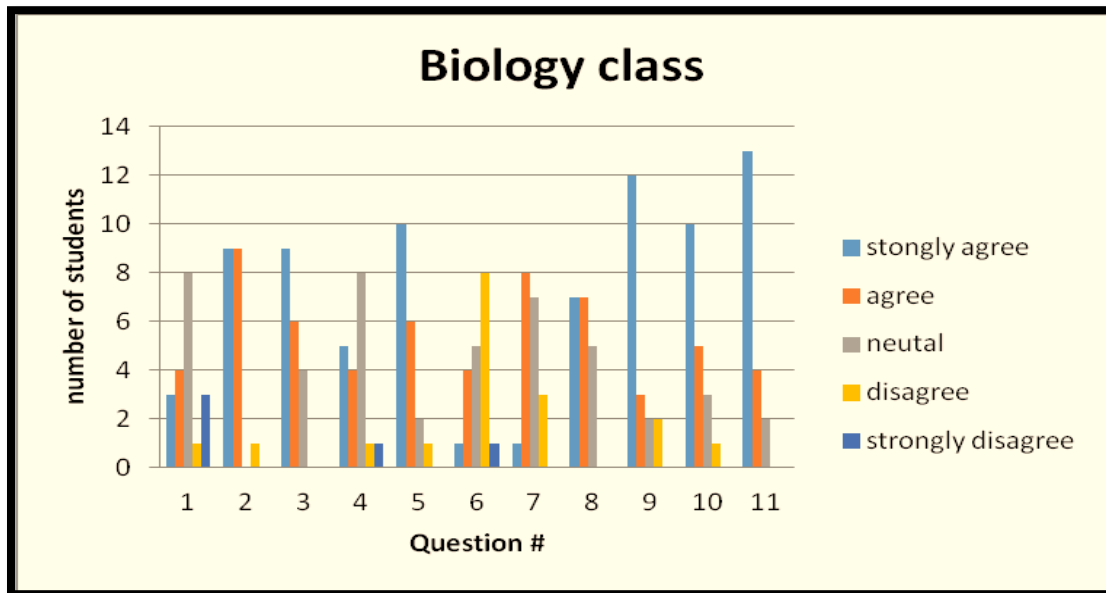
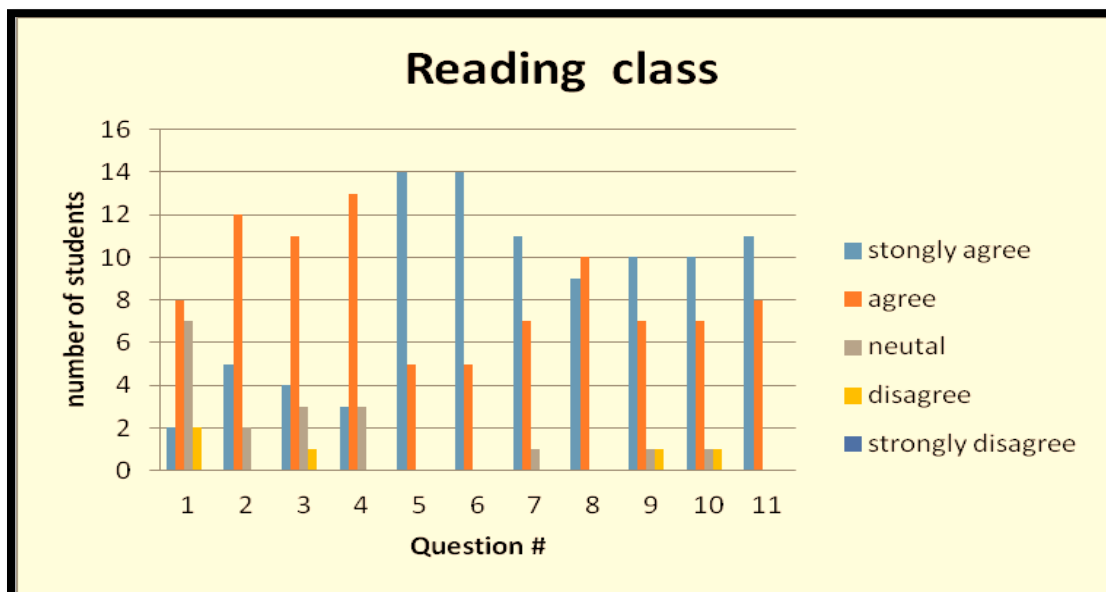


Figure 2: Reading student responses to questions



### **Discussion**

Faculty's understanding of creativity was broad; however, the definitions provided by them were categorized into three areas: innovative teaching, activity involvements, and teaching and learning. Within the innovative teaching category, teachers engaged with students by using imagination and different approaches/experiences, providing thought-provoking work, thinking outside the box, and inspiring students. Both reading and biology professors feel it is possible to improve a students' creativity and that creative skills could be developed in the classroom.

Professors revealed positive responses when answering questions associated with teaching and addressing the needs of creative students. They were more likely to teach for integration and motivation. Professors were more likely to provide opportunities for their students to regularly work in groups, and they were more likely to offer emotional support for frustrated students, offer time to look at their work, and expect them to check and evaluate their own work before handing it in.

In the reading class the general consensus amongst the students was that they enjoyed classes that stimulate creativity. They considered that creativity was not apparent in biology classes, and that there was less creative teaching as they progressed through their undergraduate degree. They also reflected creativity to be integral to how they used their time, enabling them to adapt to the needs of a situation at the classroom.

Students reported that creative approaches in the classroom could help their learning. This was illustrated by students clearly remembering certain creative approaches they had undertaken and the associated theory related to it. There was no evidence to support that creativity in their classes enhanced overall learning; one can conclude that if students could



recall the theory and the class, this would help students' understanding and therefore result in success in examinations.

Both professors decided to apply creative thinking strategies with students. They liked to help their students to achieve a better understanding. In the reading class the professor used the SQ3R strategy and the students used flash cards to write notes about a book they read outside the curriculum. In the biology class, on the other hand, the professor followed the curriculum but tried to make his students think outside the box; he liked to engage them in an open discussion to be sure that they understood the material.

The class environments helped students to develop their creative thinking; there were fewer students in the reading class, which helped the professors to better communicate with the students and give them more time to listen to and direct them to think creatively.

The findings revealed that professors agreed that problem solving is a strength of some students. They acknowledged an awareness of the positive impact of creativity in their teaching to equip students with necessary employability skills for the future. However, there were some slight differences in opinion to this question, and this could be due to the nature of the different teaching subjects.

The professors reported that they provided creative teaching and learning environments in a number of different ways. These creative experiences served to expose students to a range of thinking styles, problem-solving, and other skills such as team-working or independence. Thus, encouraging creativity for learning in the classroom may help students to develop the appropriate workforce skills by using their imagination and independence. Therefore, they require the confidence from the department's management to establish a safe classroom environment suitable for exploration and risk taking and for errors to be made by their students. They also

require the time within a busy day and a curriculum that allows students to be creative. Developing potential links between subjects provides an avenue for students to explore their learning in different surroundings. This could be a method to aid students' development of basic skills and creativity in other subjects. They believe that all instructors have to be creative, and the different applications of creativity amongst instructors should be encouraged in order to develop further novel approaches and ideas to be used in the classroom.

**Some factors affecting the development of creative thinking:**

1. Personal qualities of the individual, like the unwillingness to think outside the box, is one factor in the development of creative thinking.
2. Simulation is a negative factor that copies the individual's ability to innovate while independence from the indifference of others, and their opinions will contribute to the development of creative behavior.
3. The absence of encouragement limits the capacity of individuals think creatively, where criticism and repression limits their ability to express their ideas, unlike others who have opportunities and freedom of expression.
4. The teaching methods and techniques that depend on memorization and stuffing the brains of the students do not give the right information to the students, while unrestricted educational methods allow opportunity of free thought.

**Conclusion**

There are fundamental differences between teaching biology and reading at the undergraduate level using creative thinking. Biology requires existing knowledge of some content and the ability to think outside the box that makes it attractive for people with higher cognitive functions. On the other hand, collaborative efforts in a creative thinking scenario

would work best for reading instruction because of the unique mix of personalities and mindsets. Carter (2004) says that pedagogical techniques play a major role in teaching through creative thinking because they do not use the traditional structured model. The structured model is rigid and confines people's thinking to what they can see and touch rather than the abstract. It would appear that the definition of creativity is restricted and personal to each individual, and hence, a comprehensive definition could develop an in-depth meaning of creativity. The place of creativity in the curriculum has been deemed important. Therefore, a creative area in the curriculum would be necessary to see how creativity can contribute to students' learning. Creative instruction needs to be encouraged to teach more about creative thinking. If creative instruction is implemented in the classroom, students will be able to learn and positively impact the community around them. I think that creative thinking is not a skill that can only be used in the classroom, but as a tool that can be used throughout a student's life.

### **Recommendation**

In light of the results of the study, I can provide a set of recommendations aimed at strengthening the trends:

1. Conduct studies on a larger sample to give us more data.
2. Provide specific training and seminars for the teacher to develop creative skills.
3. Teach creative thinking classes to develop the skills of the students.
4. Develop a more creative curriculum for students.
5. Create a good atmosphere in the classroom to encourage creative thinking in students.
6. Encourage students to use more of their skills, such as reading and technology, to develop their own creative thinking.
7. Prepare a specific program about creative thinking and share this through social media to help the community to understand the importance of creative thinking.

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**(Appendix A) Check list**

Class name:	All the time	6	5	4	3	2	1	Never
1. The teacher has a good relationship with the students.								
2. The teacher uses the style of discussion in the classroom.								
3. The teacher uses the computer to strengthen his explanation for the lesson.								
4. The teacher uses small groups in the classroom.								
5. The teacher poses questions to students from time to time to make sure that they understand the material.								
6. The teacher allows students to ask questions during the explanation.								
7. The teacher shows interests in answering the questions of students.								
8. The teacher allows students to exchange ideas and point of view in the classroom.								
9. The teacher takes the students suggestions seriously.								

**(Appendix B) Interview**

1. What is creative thinking?
2. Do you have an idea of creative thinking strategies used by the teacher in the classroom?
3. Did you attend any training courses to teach creative thinking strategies?
- 4-Can you provide examples of some of the activities used with students in the classroom?
- 5- Do you have enough time in class to apply creative thinking strategies with students?
- 6-Do you adhere to the curriculum and do you use any other methods to teach?
- 7-What are the main strategies of creative thinking and the most benefit for students?
- 8-Do you think that the use of strategies, such as creative thinking strategy to play or to ask questions, helps students to understand the material better and to raise the student academic level?

**Appendix C) Survey**

Please choose one of your classes and rate your answers to the questions below

Class name:	strongly agree	agree	neutral	disagree	strongly disagree
1- The teacher rewards outstanding students					
2- The teacher uses different teaching methods in the explanations of the lesson					
3- The teacher responds to re-explain the lesson in different styles					
4- The teacher helps us to discover our talents and abilities					
5- The teacher allows us to participate in the lesson					
6- The teacher assigns us several activities in the classroom					
7- The teacher assigns us several activities outside the classroom					
8- The teacher encourages us to think and to create					
9- I feel equal to my colleagues in the classroom					
10- I feel equal to my colleagues outside the classroom					
11- . teacher makes the right atmosphere for us in the classroom					