

Fostering Problem Solving & Creative Thinking in the Classroom: Cultivating a Creative Mind!

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“The preservation of this nation’s way of life and future security depends upon its most important national resources; intellectual abilities and, more important, creative abilities. It is time, then, that we learn all we can about those resources” (Guilford, 1959, p. 2).

ABSTRACT

In a swift binary globe that is engaged in uncertainties and complex challenges, how can teachers create and foster a learning environment that promotes creative thinking and problem solving skills in students? What types of methods and classroom climates do teachers need to promote to face a challenging electronic world, and how might students react to such constructive classroom environments? Therefore, this article puts forth a discussion of the complex nature of creativity and shares the results of a one-year study conducted at a college in the state of Texas. In this study, the researcher explored teaching methods and classroom climates created by exemplary teachers who demonstrated extraordinary instructional approaches, styles, and methodologies that contributed into building creative learning environments in which creative thinking and problem solving skills were promoted.

Keywords: *creativity; problem solving; instructional strategies; constructivism; learning*

Several studies of educational psychology and business literature (Alexander, Murphy, & Woods, 1994; Campbell, 1995; Carr, 1994; Covey, 1989; Dacey, 1989; de Bono, 1992; Dent, 1995; di Sessa, 1988; Drucker, 1986; Gates, 1995; Hamza, 1998; Hamza & Alhalabi, 1999; Hamza & Farrow, 2000; Hakim, 1994; Kauffman & Hamza, 1998; Lavin & Johson, 2005, Parker & Case, 1993; Postman, 1993) indicated that numerous educational, teaching, and academic factors greatly influence a student's future learning and future productivity in the career workplace.

Available research in educational psychology (Alexander, Murphy, & Woods, 1994; Dent, 1995; di Sessa, 1988; Kauffman & Hamza, 1998; Pintrich, Marx, & Boyle, 1993; Postman, 1993; Torrance, 1987; Torrance & Safter, 1990), in supplementation to life experiences, workplace experiences, and individual insights, uncovered deficiencies in educational teaching methods and strategies in which creative thinking and problem solving are taught at the all educational levels. Moreover, observations of numerous academic experiences that students meet during their college years suggest that these deficiencies in teaching methods and strategies significantly impede students' abilities to become productive workers. At *Lone Star College ("LSC"), located in the Central Texas State College District ("CTSCD"), administration sensed that such an obligation was unfulfilled (Appendix C). Therefore, the CTSCD surveyed 450 students asking the following questions: "Given that a student who leaves this college should be a contributing member of society, what do you think are the important skills, abilities and awareness critical to your college education?" Responses to this question did not include but of a few, less than 8, suggestions that students should possess creative thinking and problem solving skills to survive a tough and competitive "Real" world. None of the responses pointed out anything about creativity or its role in preparing students face an ever-changing information globe. In a world that is striving on a continuous flow of creativity and innovation, the survey finding was dazzling to the college's administration! Therefore, the authors of this paper conducted this study to identify and explore exemplary instructional approaches of eight *carefully* selected college professors who fostered learning environments that nurtured creative thinking and problem solving encouraging students to think creatively and critically. The research questions that helped guide the exploration process were:

1. What types of methods, strategies, interactions and communications did the teacher practice to develop creative thinking and problem solving skills in students?
2. In what ways did individual characteristics of the teacher promote creativity in the classroom?
3. What were students' attitudes toward a classroom environment that promoted creative thinking and problem solving?

Methodology

This study focused on exploring, investigating, and identifying teaching methods of exemplary teachers. The researcher elected to conduct the study at LSC for the following reasons: a) entry was possible; b) a rich mix of many processes, teachers, programs, interactions, advanced technologies, and future innovations existed throughout the CTSCD; c) to spend sufficient time in the context; and d) the researcher received permission from LSC college officials to conduct the study. The respondent pool selected was a number of professors who demonstrated exceptional methods and strategies in promoting creative thinking and problem solving in the classroom.

Students were the primary source in identifying the purposive sample of teachers. Other information, such as teacher interviews (Appendix A), creative thinking checklist (Appendix B), and students' responses (Appendix E), assisted the selection process. The researcher conducted semi-structured and informal interviews with selected students and respondents. A purposive sample of teachers emerged, in which the researcher observed, collected, and analyzed perceptions, attitudes, styles, interactions, and strategies in classroom instruction that foster learning environments to attempt to promote creative thinking and problem solving. To meet necessary criterion to fit the purposive sample, a student should have attended LSC for not less than one year and should have completed not less than 10 courses at the LSC campus. The respondent pool of teachers at LSC did not include part-time adjunct instructors because adjuncts do not hold permanent positions or long-term contracts and thus students might not had the opportunity to

Therefore, the researcher conducted continuous, semi-structured and informal interviews with selected students and respondents. The researcher developed interviews using the ethnographic process recommended by Spradley (1979). The data that the researcher collected from classroom observations, exploration, investigation, and surveys of student attitudes toward such classroom environments assisted in preparing the analysis of findings. Artifacts (for example, tape recordings and computer software) also assisted in the data collection and analysis processes. Documents from literature (including CTSCD's district survey and other related documentation), teachers' curriculum vitas, other important and exclusive information, and students' letters to teachers, available referential documents, and data from formal and informal conversations with students and teachers were also part of the data collection process.

Procedures

The researcher used the following procedures to conduct this study:

- The study progressed in three phases (Appendix D). In Phase I, lasted 5 months, the researcher conducted semi-structured and informal interviews with students and teachers. A total of 210 semi-structured interviews and informal interviews were conducted to assist in the selection of the exemplary teacher pool. In addition, the researcher selected and interviewed teachers mentioned most frequently by students from the data collection and data analysis who demonstrated strong indications of fostering a learning environment that promotes creative thinking.

Data collection, data analysis, member checking processes, and constructs emerging brought to the hermeneutic-dialectic process (HDP), a method used in naturalistic observation research to establish authenticity in which emerging constructions of all stakeholders (involved parties such as administration or teachers) have equal entry to the process to share conclusions, recommendations, and courses of action. Simultaneously, the process educates and empowers all involved parties. The HDP was continuous throughout the research study. Data collected and analyzed, from Phase I student and teacher interviews, were the primary instruments in identifying the teacher purposive sample. A checklist supporting the exemplary teacher selection process (Appendix B), emerged from data analysis, findings, and synthesis of extensive literature review and assisted in the development of a checklist.

In Phase II, lasted around 3 months, the researcher continued to add data to the reflexive journal, research literature, documents examinations, peer debriefing, data collection, data analysis, and member-checking processes. The researcher attempted to form connections among shared constructions by introducing them to the hermeneutic-dialectic circle. In addition, the researcher conducted classroom observations and explorations of eight teachers' classrooms. Phase III, the final phase, a continuum of Phases I and II, included the survey of student attitudes in observed classroom settings and the report summary. Data collection and data analysis continued in preparing the final report. Data collection and data analysis continued in preparing the report and final presentation.

- Continuous data collection and analysis from classroom observations, informal interviews, teacher interviews and surveys, and surveys of student attitudes contributed to the creation of short case studies, for additional data analysis, of each teacher.

- The researcher conducted most interviews face-to-face; however, some interviews took place by telephone when students were unable to meet with the researcher in person. Data analysis and integration emerged following data collection from each interview, observation, informal interview, critical incident, and informal conversation with respondents.
- The researcher established authenticity by bringing all constructions to the hermeneutic-dialectic process. Thus, constructions of all stakeholders owned equal entry to the process to share conclusions, recommendations, and courses of action. To achieve higher-level synthesis of information and to allow for mutual exploration by all parties, the researcher collected divergent views of the stakeholders, compared these views, and contrasted them (Guba & Lincoln, 1989).

Analysis of Data

The researcher gathered data and analyzed it according to naturalistic inquiry and ethnographic guidelines outlined in the constant comparative method, an interactive process that consists of three concurrent flows of activity. Those three elements are: data reduction, data display, and conclusion presentation and verification (Erlandson, Harris, Skipper & Allen, 1993). Data analysis followed each interview, each observation period, and at the conclusion of each field setting exploration. The researcher independently categorized, coded, and systematically examined data to determine whole and component relationships. The researcher collected, categorized, and sorted data following interviews, explorations, observations, and attitude surveys. In addition, he collected data from recent interview responses, for example, and compared it with previous responses to search for inconsistencies, discrepancies, anomalies, and negative cases.

Systematic steps in analyzing data collected from this study involved constructions from context and revision of these constructions into meaningful whole relationships as prescribed in Lincoln and Guba's (1985) four-step process:

- Using disaggregated data from paragraphs, observations, and notes into the smallest pieces of information, the researcher separately recorded the contents of each interview question and observation data; they could exist independently without additional information other than broad, general understanding of context.

- Emergent category designation, commingled with provisional categories on index cards that related to the same content. All units of data corresponded with

categories of ideas. New units that were not a good fit when compared for similarity to existing categories received new categorization.

- The researcher used negative case analysis through hypothesis refinement processes until it accounted, without exception, for all known cases. Attuned to discretionary interpretations from respondents and accompanying collected data, the researcher probed for data that refuted constructions of reality.
- The researcher bridged data whenever two or more categories suggested an unidentified link from earlier data collection. Emergent categories supplemented additional data collection. Rich, untapped data sources surfaced for later data collection, exploration, and analysis.
- The process of interviewing, analyzing, observing, and identifying new respondents continued until information became redundant or until it fell into two or more construction categories that remained at odds with each other. The researcher expanded the sample of respondents until redundancy, regarding information, was reached and consensus was achieved. At that point, sampling concluded. Then, the researcher brought all constructions to the hermeneutic-dialectic process (HDP) to reach consensus and to simultaneously educate and empower all involved stakeholders.
- The researcher followed methods guidelines of *Naturalistic Inquiry* (Erlandson, et al., 1993; Guba & Lincoln, 1989; Lincoln & Guba, 1985) to communicate complex interrelationships and multiple realities from the setting of the study to allow cognitive, emotional interaction by the intended audience.

In addition, the researcher applied various naturalistic inquiry techniques to establish trustworthiness and provide credibility, transferability, dependability, and conformity. Because teaching, learning, and educating are complex structures, it would not be possible in this study to investigate, explore, and report findings of all variant educational factors imposed by teachers and educators that influence a student's future productivity in the career workplace.

To certify the trustworthiness of this study, the researcher employed the following techniques:

- To establish credibility (the equivalent of internal validity), the researcher used a number of methods to certify that the processes of gathering and analyzing data did not compromise accuracy. To better understand the environment of individual classrooms, the teacher's use of methods and strategies in the classroom, and the culture of social settings, the researcher engaged in tenacious, prolonged classroom observations. These lengthy observations

enabled the researcher to distinguish normally occurring circumstances from distorted perceptions of the classroom environments induced by specific events or by freshness of the researcher and respondents to each other's presence. Prolonged engagement also helped the researcher to build a trusting relationship

with respondents. During the interview or immediately following, the researcher used member check with each respondent. Formal or informal comprehensive member checks reaffirmed the accuracy of the findings.

Continuously and regularly the researcher, together with peer debriefers familiar to the research and its participants, reviewed data gathering procedures, analysis, and findings. Peer debriefers analyzed, reviewed, and listened to the researcher's ideas and concerns and asked probing questions to test the hypothesis and emerging design. Through methodological triangulation, the researcher cross-checked data interpretations collected from interviews, referential materials, observations, and related information. Student reports, documents, syllabi, curriculum vitae, comments, newsletters, and memos provided background meaning to support data analysis interpretations and audit. Reflexive journal entries recorded by the researcher enabled the researcher to process the research and reflect upon it as the study matured. In addition, the researcher sought discretionary explanations or interpretations of the data.

- To determine transferability (the equivalent of external validity), the researcher used purposive sampling methods in selecting respondents who might provide the most information.
- Certify dependability (the equivalent of reliability) the researcher participated, throughout the interview process, in peer debriefing with an interested and informed individual. In addition, the researcher presented this research proposal at local and national conferences. Furthermore, the researcher also met with academic and industry professionals to share the constructs emerging from this study with them. The established audit trail will assist an auditor in determining the trustworthiness of the study and will demonstrate that the paperwork accurately and correctly reflected the process and interpretations made by the researcher.
- To establish confirmability (the equivalent of objectivity), the researcher constructed and maintained an audit trail, a recordkeeping system that provides for a thick description of the inquiry context and the process used to investigate it. To represent the research study process, all data remained in files, raw data files, data reduction files, and data reconstruction files.
- The researcher established authenticity by combining all constructions with the hermeneutic-dialectic process. All stakeholders had equal entry to the process to share their constructions regarding conclusions, recommendations, and courses of action.

Conclusion

For decades, education in the US endured a silent and gradual revolution in goals and methods used to increase the awareness toward creative problem solving and creative experiences. However, many educators have not yet realized that such changes occurred toward more creative education. Similarly, little significant change occurred in teaching methods and teacher-student relationships (Hamza & Alhalabi, 1999; Smith & Ragan, 2000; Torrance, 1977; Torrance & Safter, 1990).

Several significant factors emerged from this study's interviews and classroom observations of students and teachers at LSC that contributed to a greater understanding of learner, teacher, and the sphere of creative thinking. These factors can significantly aid teachers in creating creative learning environments that foster problem solving skills and creativity in their students. And, although these factors differ in nature of creation and intensity among teachers and observed classrooms, such factors become pillars in building climate that fosters creative thinking and problem solving. Careful analysis of the data indicated that these factors recur in interview responses (Appendix E) and in classroom observations. These factors include: climate, teacher personality (character traits), teacher attitude (toward subject and teaching), classroom management, teacher knowledge, teacher-student interactions, and student attitudes (Appendix F). Constructions that emerged from this study show that there is no ultimate method to use in teaching, nor is there an ultimate way to foster a classroom learning climate that promotes creative thinking. Although these teachers differed in personality, in style of teaching, and in the climate they created, they shared common, valuable qualities. They: 1) learned from failure and success; 2) possessed a strong passion for what they do; 3) drew from massive experiences, exercising positive influence in teaching and learning; 4) cared about student success and failure; 5) experienced life from unique perspectives; 6) were very interested in the subject taught; 7) possessed general knowledge of other fields and areas of study; 8) used analysis and synthesis processes in decision making; 9) developed a rich body of knowledge in the subject taught; and 10) created unique, original styles and methods of teaching.

Such characteristics enabled these educators to manifest miraculous results in the learning process that reflected in student responses and survey of attitudes. Some teachers appeared to be more analytical, logical, and systematic; some appeared to show greater encouragement for exploration and discovery. Some had the combination of both. Despite their individual styles, approaches, and differences to classroom instruction, all of their expressed teaching behaviors were

spontaneous, intuitive, unique, and original. In contrast, however, this nation's educational system tends to emphasize more sequential, linear, logical, analytical, individualistic, and field-independent cognitive styles (Hilliard, 1989; Kuykendall, 1992).

According to Torrance and Safter (1990), students prefer to learn creatively by exploring, questioning, experimenting, manipulating, listening, and testing. Reacting to powerful cultural forces, however, educational institutions encourage intelligence and logic, insisting that students learn by authority. Notably, students do not learn exclusively through authoritarian command. Authoritarian systems of learning lack flexibility, originality, elaboration, uniqueness, novelty, fluency, and purposiveness of creative thinking. "The preservation of this nation's way of life and future security depends upon its most important national resources; intellectual abilities and, more important, creative abilities. It is time, then, that we learn all we can about those resources" (Guilford, 1959, p. 2, Masuri & de Corte, 2005).

In *A Climate for Inventing*, Paul Torrance wrote: "When men or nations invent they live and grow. When they cease to do that they decay and die. This has been true from the beginning" (Torrance, 1987, p. 235). Teachers and students at both colleges came from diverse backgrounds; however, both strived to create a unique experience that promoted creative thinking and problem solving in students and teachers, alike.

Many of these students seemed to learn better and think more critically and more creatively in a "safe environment," a term which students and teachers used frequently during their interviews. To their way of thinking, safe environments are settings in which they do not feel threatened, but feel comfortable to express opinions and ideas. Many of these students are intuitive, courageous risk takers; they are brilliant, open to change, creative, emotional, dedicated, and care much about their learning experience. In return, they also hold the same expectations of their teachers. When they visited with the researcher about what constitutes a creative environment, students used the following key words most frequently to express their opinions:

Learning; fun; interest; freedom to voice opinions; enthusiasm; comfortable and safe environment; humor; challenge; openness; love of the teacher for teaching and for the subject taught; encouragement to think; student-teacher interaction; student-student interaction, respect, and challenge of one's own thinking.

They also expressed opinions about experiences that they usually had as students. Those experiences sharply contrasted with experiences they had with favorite and exemplary teachers. In those classrooms students frequently commented that, unlike the creative environments mentioned above, they felt stifled

in expressing creative ideas. In addition, they felt an overwhelming pressure to conform and obey to rigid classroom structural guidelines. On the other hand, the respondent pool of teachers selected for this study was open to new possibilities. Most of them spoke openly about the need to change an antiquated educational system. And most expressed their disappointment with a rigid and “so-traditional”

system of thinking and learning. They responded favorably to student concerns, ideas, and questions; they verified the importance and value of student ideas; and they were skillful in capturing students’ attention. In addition, they understood the significance of basic skills to creativity and emphasized these skills in their classrooms. They guided students through the learning process with care, wisdom, and knowledge. Some teachers used many approaches not only to motivate students in their thinking, but also to produce interest and excitement. Frequently they constructed debate, discussions, and role playing scenarios to accomplish such goals. Without exception, all of these teachers connected prior information and prior required entry skills to new information and new knowledge. They used brainstorming activities and synectics (a well-known creative thinking technique of making the familiar strange and the strange familiar) exercises to relate problems and ideas that seem difficult, if not impossible, to relate. Throughout the learning process, these teachers used critical monitoring and continuous evaluation methods (by way of discussions, group projects, or teacher-student interaction) to assist in diagnosing the prerequisite skills that the students already possessed. Making these evaluations by the teacher were essential in planning instructional focus and individually guiding students’ needs in learning new materials and new skills. Intrinsically, these teachers were able to minimize confusion and avoid unnecessary instructions; this permitted extra time for the teacher to focus on problems such as skills deficiencies and content misinterpretations (Gagnè, et al., 1992; Smith & Ragan, 2000). Some of the teachers encouraged students to create the connections on their own; others created the connections for them. All of these teachers showed respect toward the students and treated them as adults, younger colleagues, and future professionals.

As controversial debates emerged from opposing student views, these teachers showed respect for each individual’s opinions. Moreover, they were not afraid to tell students, “I don’t know.” None of these teachers claimed that he or she had all the answers; all of them searched for answers when students presented obscure questions. These teachers also provided guidance and direction to students; they critically, constructively, and creatively monitored and coached questions, activities, and exercises. Without exception, all of these teachers dedicated much time and effort beyond the physical time limitations of the classroom.

Before, during, or after the lectures, some of the teachers engaged students in activities, exercises, and games. These teachers informed students of the purpose of such activities. Other teachers lectured and engaged students in learning by arousing their attention and interest for the subject matter. Despite the nature of the

subject, all teachers stirred student interest by comparing important, related issues with unrelated issues. Through their unique style of teaching, these teachers possessed a rich body of knowledge domain specificity and expertise. They also possessed nonspecific global knowledge in other unrelated areas. None of them followed a script, rigid or otherwise; however, all of them knew where they were,

where to go, how to get there, and when they arrived to achieve content learning objectives. Despite their instructional styles of content, these teachers recalled definitions and discussed non-context related topics to analyze complex ideas; they transmitted information efficiently and effectively.

These teachers emphasized the significance of meaningful, newly formed information used in discretionary problem solving by collecting data, processing it, sorting it, and categorizing it. All used uniquely individual approaches to stimulate curiosity and interest in students; they told jokes, used humor, used individualized stories, used previous and current events, and used metaphoric analogy. They not only aroused such interest, but also helped students expand their insights and depth of knowledge.

Answering students' questions with other problematic questions, teachers created semi-structured and open-ended environments to enhance student thinking and decision making skills. These teachers were leaders, facilitators, and coaches of their classrooms; they balanced the academic climate they created through intuition and inquiry to better serve the student's needs of learning and thinking. With teacher as guide, many students appeared encouraged to dig deeper; to explore the unknown. These teachers inspired students by their positive attitude and their strong passion for what they do. This attitude not only encouraged students to learn, but also helped to create a positive climate that promoted learning enjoyment. Teachers enjoyed what they did and shared this enjoyment with students. Leading their classroom by example and continuously seeking to inspire appreciation for learning excellence, these teachers accepted countless efforts to become role models for their students.

Some well-structured teaching methods were lecture based; other teachers preferred a looser style of instruction. They conducted various activities centered on the learner through class discussion, group discussion, games, sociodrama (acting out issues and conflicts), brainstorming, and synectics. They did not allow their individual teaching methods, however, to preclude them from accompanying students on a journey of thinking and exploration. Some teachers, more than others, practiced various methods and strategies to create an environment that fostered learning and creative thinking. Worthy of mention; the strength of this study does not live in one exemplary teacher's style, methods, or strategies. The synthesis of these methods, styles, and strategies should help create learning environments that promote creative thinking and problem solving.

The difference between good teachers, effective teachers, and creative teachers caused confusion for the researcher as he attempted to answer this complex

question. To solve such a challenging question, the researcher traveled to meet with a world renowned educational psychologist, Dr. E. Paul Torrance, and posed this perplexing question to Dr. Torrance. Between good, effective, and creative teachers, Dr. Torrance replied that there is no difference between good teachers,

effective teachers and creative teachers. He acknowledged that a good teacher is both effective and creative.

Understanding, measuring, and developing the creative thinking abilities are part of the educator's great dream of achieving a more humane kind of education in which all children will have a better chance to achieve their individual potentialities. It is of obvious importance to society that creative talent be identified, developed, and utilized. (Torrance, 1977, p.33)

Emergent constructions from this study created findings that tended to concur with Dr. Torrance. In conclusion, the researcher proposes the following additional interpretation: Good teachers might be effective teachers; however good teachers might not be creative teachers. Good teachers might be effective teachers if they used their effectiveness to the advantage of the learner to achieve educational purposes; however, effective teachers might not be creative teachers. Creative teachers need the positive characteristics of good teachers and effective teachers. Otherwise, their novelty and uniqueness in being creative might be unfulfilled.

Teachers and students collaborated in these observed classroom settings to explore questions, to detect problematic scenarios, and to seek possible solutions. However, these teachers differed in the way they sought such answers. Some teachers based their primary methods of teaching on discussion, controversial debates, drill-and-practice, exploration, and discovery. Other teachers based their primary instructional methods on lectures and presentations. To varying degrees, their methods addressed the four domains of learning. Some teachers focused on the cognitive learning domain; other teachers focused more attention to the affective domain involving motor skills and interpersonal skills. Only three of the eight teachers incorporated the elements of all domains. Such focus seemed to vary according to the discipline of the subjects taught and according to the teacher's interest in the subject that he or she teaches.

Most students in this study seemed preoccupied concerning the manner in which teachers treat them. Many students' responses showed great appreciation and admiration for the teachers selected for this study. They indicated great respect for these teachers who treated them with respect, honesty, and integrity. In addition, the students also showed appreciation for teachers who perceived them as adults; as human beings with individual entitlements, needs, feelings, and diverse

abilities. Many of these students who praised the teachers in this study told the researcher that they sensed a lack of attention and a lack of communication during the course of their academic studies with some other teachers. As a result, the students felt rebuffed by the teachers who disavowed them. Their perceived rejection produced negative impressions, apathy, and strong dislike for some. Moreover, the researcher noted during classroom observations that less structured classroom management

seemed to provide greater flexibility and greater probability for students to explore than did well-structured classrooms. Students had a tendency, however, to favor some structure as opposed to no structure at all. They preferred to know what the teacher expected of them to achieve required instructional objectives. What students seemed to fear most is failure; and, when they lacked required entry skills, they also seemed to have less self-confidence. They preferred a more clearly defined classroom structure because it reduced ambiguity of academic content. Other students, accustomed to well-structured classrooms, complained about disorganization and lack of classroom learning structure. Many students correlated structure with conformity, control, lack of flexibility, and traditional lecturing.

Students' expressive responses suggested that they need to feel a humanitarian alliance with their teachers. Achieving balance of structure and flexibility in classroom environments; achieving instructional objectives; accommodating diversified learning needs; these exemplary teachers shared all these qualities. A teacher's ability to captivate student interest and motivate curiosity during the learning process seemed important in achieving learning objectives of the content and in educating them.

Most students showed great interest in learning by creative instruction methods and by analytical instruction, as well. They favored a relaxed, comfortable climate over an authoritative, conforming climate. Students favored teachers who listened to them; who showed feeling, opposed to teachers who issued orders and demands. Open communication between student and teacher seemed to build trust in them. Exemplary teachers carefully, purposefully, and deliberately selected and organized the material that they presented to students. They did not follow rigidly existing guidelines, since their body of knowledge is rich and in-depth; however, they were mindful of learning objectives and how to achieve them. They created an open climate; an encouraging supportive environment that enabled students to extend their efforts in learning to become independent thinkers and problem solvers. Most students preferred the teacher to lead the classroom by coaching, directing, and facilitating the total learning experience.

Notably, some teachers use teacher-centered methods; they are creative in the sense that they focus on themselves in the classroom. In this kind of classroom, teachers lean upon newness and novelty; they entertain students by doing something out of the ordinary and contravene existing rules to gain popularity with their students. However, such creativity is not student-centered; it is not monitored or

evaluated critically, logically, or reasonably. It is also important to note that four of the eight teachers in the purposive sample agreed that their ideas are not supported at LSC. In their opinion, the system is not flexible because it does not accommodate change. Significantly, two of these four teachers are considered 'technology gurus,' at LSC. They integrate technology in their classrooms and possess higher technological skills than the rest. Three of the four teachers who sensed a lack of support for their ideas used combined methods of instruction. As a result, the use of

these combined methods seemed to allow greater propensity for creativity in the classroom. Interestingly, the eight teachers selected for the purposive sample exhibited great variance in classroom instruction concerning integration of technological tools. Some appeared to be enthusiastic about new technologies and actively sought to increase their knowledge in these areas. Others did not use new technologies in their classrooms, or they used them very little. These teachers appeared to be apathetic toward technology and indicated that they avoid using these tools.

All eight teachers agreed that many incoming students lacked required entry skills; therefore, they attempted to reinforce and refresh in students the required entry skills necessary to study the current subject. In addition, many critical incidents collected by the researcher throughout the study confirmed statements made by teachers that described obstacles and challenges to the integration of technology in classrooms. During the time the researcher conducted this study, the college president and two of three division heads serving in middle management positions resigned. In addition, administration created a fourth academic division. Individuals at LSC responsible for making many academic decisions concerning the use of technological tools still hold key positions.

Summary of Observations

Constructs emerging from this study indicate the importance of fostering a learning environment that promotes creative thinking and problem solving. As a result, the researcher observed that these teachers constructed teaching methods by uniting and nurturing the following elements: 1) classroom climate; 2) teacher character traits; 3) classroom management; 4) teacher's passion and attitude toward students, subject, and teaching; 5) teaching style: what and how; 6) teacher's knowledge; 7) teacher-student interaction; and 8) students' attitudes.

Feelings, attitudes, behaviors, boundaries, and constraints influence a classroom temporary culture, generally a term of one semester in length, created by teacher and student. During this study, the researcher observed that those

classroom climates that promoted creative thinking and problem solving were: open, comfortable, relaxed, challenging, safe, supportive, trusting, humorous, energized, and collaborative. Such climates rewarded creative behavior and encouraged thinking and exploring processes; students were free to voice opinions through non-threatening, entertaining, and enjoyable methods. The exemplary teachers selected for this study shared many character traits. They were: approachable, personable, creative, caring, flexible, knowledgeable, energetic, interesting, motivating,

imaginative, innovative, aesthetic, seekers of possibilities, leaders, insightful, original, and unique.

In addition, the researcher noted that the teacher's ability to manage conflicts and minimize disruptions, to design classroom physical set-up, and to create innovative classroom activities were important to smoothly managed classroom environments. The researcher observed that passion for subject content influenced the manner in which an individual taught the classroom; which, in turn, reflected a strong commitment to student learning and success. Notably, the researcher observed that teachers who enjoyed positive attitudes toward students and subject content stimulated inquisitiveness in their students and a resulting interest in the subject matter.

How someone teaches is vital to learning. A teacher's use of diverse methods and strategies in presentation of subject content, in leading discussions and debates, and in encouraging small group interactions, nurtures a student's curiosity. These approaches encourage students to study issues from contrasting views. The selective content of what to teach is yet another important element. Focus upon the quality of instruction, not upon the quantity of information presented, assists teachers in sustaining student curiosity and encourages abstruse exploration. The researcher observed that the exemplary teachers selected for this study exhibited an in-depth and rich specificity of knowledge in the subject matter and the field of study. These teachers also held considerable knowledge about other issues, topics, and domains. The researcher also observed that teacher-student interaction in the classroom sought numerous possibilities in fostering creative climate. In addition, these teachers displayed much respect toward the students who asked unusual questions and who held opposing opinions.

Recommendations

During this research study, the investigator received numerous comments from teachers and students concerning the manner in which teachers might select

and might organize new information in content presentation with prior knowledge and prior information, and required entry skills. It is the learning outcome *objectives* that guide and evaluate classroom instructions; and not the classroom instructions that guide and evaluate learning outcome objectives (Gagnè, et al., 1992; Hamza & Alhalabi, 1999). The collection and synthesis of data suggest that the basic nature of learned information is far more important than the numbing process of memorization and regurgitation of information. As affirmed by the teachers interviewed in this study, teachers need to find ways to encourage students to produce their thinking. Teaching is a means to a goal, but it is not the final goal.

Exercising care in the thoughtful planning of content delivery manifests greater comprehension by students of the subject matter. Thorough presentation of abundant information exacts a clearer focus on the primary meaning of content to help students understand ideas.

Focus on the memorization of trivia does not necessarily allow students to grasp a broader understanding of subject content. Today's competitive world needs independent, creative thinkers; the rise of the information age sets our world on a pilgrimage of new discovery. Most new technologies and inventions emerge from the synthesis of existing knowledge by individuals who cast aside unforgiving rules. These individuals violate such rules, not from insurrectionist behavior or for the simple pleasure of violating preexisting regimens, but do so for purposes of creating new rules and exploring new paths.

An innovative teacher can create ways to build mutual successes between themselves and their students. A preliminary step to academic success is the teacher's attitude toward students and envisioned student success. Therefore, the researcher suggests that teachers attempt to tolerate new ideas and differences of opinion. Expect students to make several attempts toward success until they achieve it. Continuously work with them toward their successes (Appendix J). Be courageous. Be willing to risk the venture of fresh avenues of teaching and learning. Build teamwork in the classroom. Consider what triggers, inspires, and motivates a student's intellectual and individual interests. Relate real world experiences to students; educate them not only students, but also as individuals and citizens. Be positive; reflect a positive attitude. Treat students with respect, admiration, and integrity. Challenge the imagination; encourage innovation.

Create a student-centered environment; learn together. Involve students in all processes of learning; guide them through difficult challenges of problem solving. Inspire effectual group discussions review and expand students' knowledge of learned materials, issues, and topics. Try to present open-ended, obscure questions for which there are no clearly right or wrong answers. Ask students to find discretionary explanations and solutions to solve problems. Substitute traditional testing with case studies, projects, and assignments that evaluate students' understanding. Challenge their learning through experimentation, novelty, and originality--not through their abilities to memorize.

Help students to progress gradually from being memorization-dependent to become independent thinkers and problem solvers.

Be open minded to change; encourage new ideas, opposing ideas, and challenging ideas. Be the leader of the classroom extended family. Lead with insight; extol a passion for learning. Teachers are academic leaders whom students look to for guidance and direction. During teacher and student interviews, several individuals emphasized that sometimes students never met a positive role model, although they searched endlessly for one.

Many lives depend on a teacher's talent to navigate their thinking skills into an unexplored realm of knowledge and power. They reap what they find to face a raging, competitive world. Changing an individual's life for the better through education is a miracle in itself. Education is not only about learning a skill, learning to read and write, and earning a degree. Education is also about human relationships and human interaction; it is about building a competent society where honorable, capable, professional citizens strive to understand each other and build a better future for all humankind. The authors of this articles hopes the findings of this article help teachers help their students be prepared with what it takes (creative minds) to face a complex and challenging global future.

It takes an entire village to raise a child.

-- African proverb

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APPENDIX A

TEACHER INTERVIEW

Name _____

Discipline _____

Phone # _____

1. Tell me about yourself (background, education, teaching field, length of teaching experience.)

2. In what sorts of activities do students engage in your classroom?

3. What approaches, methods and strategies do you use in the classroom?

4. What do you do to promote creative thinking and problem solving in students?

Additional notes and comments.

32.	Used open-ended, probing questions in class								
33.	Original teaching style								
34.	Less emphasis on details, sought understanding of larger context								
35.	Applied learning to self-understanding								
36.	Presented lessons from individual experiences								
37.	Aware of students' lack of basic skills and how to reinstall them								
38.	Encouraged fact finding, information gathering, and use of various strategies to sort information; categorize it; and search for solutions clearly, cohesively, and comprehensively								
39.	Encouraged students to examine issues, values, feelings, & situations from different perspectives by logically analyzing facts, connections, and assumptions, in evaluating all possible solutions								
40.	. Led discussions, responses, and directed students' attention to focus upon central issues								

TEACHER'S PASSION & ATTITUDE

41.	Possessed a strong passion for education and for educating the individual								
42.	Enthusiasm about subject taught								
43.	Showed care for students and took personal interest in their successes								

TEACHER'S CHARACTER TRAITS

44.	Playful, imaginative, and humorous attitudes								
45.	Analytical, intuitive, and sensitive								
46.	Reflective and spontaneous								
47.	Inventive								
48.	Used stories/scenarios to provide information								
49.	Aesthetic/poetic								
50.	Sought possibilities								
51.	Sought causes								
52.	Aware of students' feelings								
53.	Sought innovation								
54.	Communication style: flexible, assertive, intellectual, but not aggressive								
55.	Self-motivated								
56.	Good communicator and a good listener								

CLIMATE

57.	Created classroom excitement and interest for subject matter								
58.	Created relaxed, comfortable, open and non-threatening atmosphere								

CLASSROOM MANAGEMENT

59.	In charge of classroom operations (planning, set-up, disruption, involvement, noise, conflicts, etc.) to better suit learning and to better serve the teacher and student								
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TEACHER'S KNOWLEDGE

60.	Possessed in-depth knowledge of subject content								
61.	Continuously improved own skills and enhanced teaching strategies								
62.	Possessed rich body of general-domain knowledge								

TEACHER & STUDENT INTERACTION

63.	Continuously encouraged work group participation, classroom participation and/or individual interactions								
64.	Respect for students as younger colleagues								

EXTERNAL INFLUENCES

65.	External Influences:								
	Family								
	Administration								
	Financial status								
	Colleagues								
	Students								
	Friends								
	Weather								
	Professional Development								
66.	Facility Conditions:								
	Physical (classroom, building, etc.)								
	Equipment								
	Instruments								
	Services								
67.	Demographic Influences:								
	Location of Institution								
	Classroom location								
68.	Ease of resources access and communication with other sources								

APPENDIX C

LONE STAR COMMUNITY COLLEGE ENROLLMENT STATISTICS

TOTAL ENROLLMENT 3,661

	Percentage (%) of Student Population	Number
GENDER		
Female	60.9	2,232
Male	38.7	1,419
ETHNICITY		
White	77.0	2,819
Black	2.0	75
Hispanic	6.0	222
Asian	1.8	69
Amer. Ind.	0.3	14
Nonres. Alien	0.4	15
Missing	12.2	447
AGE (As of Beginning of Term)		
Under 20	32.4	1,187
20 - 24	32.5	1,189
25 - 29	10.8	395
30 - 39	14.1	517
40 - 49	8.1	297
50 & Over	2.1	76
RESIDENCY		
In-District	40.5	1,481
Out-of-District	57.8	2,116
Out-of-State	1.2	44
Foreign	0.5	20

APPENDIX D

TIME LINE DEVELOPMENT

PHASES I - III

PHASE I

- Research and document examinations
- Keep a daily journal
- Conceptual plan of the process
- Develop preliminary grounded theories
- Determine interview questions for semi-structured, exploratory interviews
- Check conceptual plan with a qualified researcher
- Examine referential materials and artifacts
- Conduct informal and semi-structured interviews with respondents and organize data
- Collect critical incidents
- Conduct negative case analysis
- Begin member-checking process
- Begin data analysis (categorizing data)

PHASE II

- Classroom observations
- Continue journal
- Modify grounded theory
- Student and teacher informal interviews
- Modify questions to suit a more structured interview
- Conduct interviews and utilize data
- Peer debriefing
- Continue member-checking process
- Continue collecting critical incidents
- Continue researching and analyzing documents
- Continue data collection and analysis
- Carry out comprehensive member-check

PHASE III

- Continue classroom observations
- Continue peer debriefing
- Conduct additional interviews
- Continue comprehensive member checking
- Continue researching and analyzing documents
- Continue collection, data analysis
- Write report

- Submit report

APPENDIX E

INTERVIEW ANALYSIS

Following are a listing of most frequently recurring descriptive responses made by students that emerged from Phase I interview analysis during their interviews with the researcher. These responses describe the traits, characteristics, attributes, instructional styles, instructional methods, and instructional strategies of the teacher purposive pool.

Teacher's character traits

- 1) absolutely unique
he/she got to know us at a personal level. We felt so open with him/her. He/she was always open to suggestions
- 2) he/she had a great personality
- 3) he/she had a lot of energy and enthusiasm that you felt once he/she walked into the classroom
- 4) he/she is not only a teacher, but also a friend
- 5) he/she made class fun
- 6) his/her class promoted the most creativity because of their personality and their talents
- 7) his/her enthusiasm about the subject kept our attention
- 8) open to new ideas

Teaching style

- 1) reached answers in different ways; encouraged us to do so . . .
- 2) relating things to the subject studied
- 3) they admit their mistakes and if they don't know the answers to some of our questions, they are not afraid to let us know that they don't have any answers, but they will search for them
- 4) we were asked to come up with ideas, problems, and solutions
- 5) with him/her you learn through experience
- 6) apply subject matter into real life situations
- 7) funny stories
- 8) he/she accepted ideas from us and encouraged us to pursue it; other teachers wouldn't
- 9) he/she challenged my thinking
- 10) he/she encouraged us to make our own decisions and be independent thinkers
- 11) he/she had us look at problems from different ways
- 12) he/she is an animated teacher
- 13) he/she is well organized but the class is not too structured. He/she is flexible and understanding of their students' problems
- 14) he/she likes to entertain and perform in class
- 15) he/she made class interesting;
- 16) he/she showed us an infinite amount of possibilities in solving problems
- 17) he/she simplified material and broke it down for us to understand; he/she delivered it in an interesting manner
- 18) had a captive audience
- 19) on time; doesn't miss class
- 20) he/she listened to us

Teacher's knowledge

- 1) he/she is very knowledgeable

- 2) he/she is a wealth of knowledge

Teacher's passion and attitude toward students, subject and teaching

- 1) he wanted us to succeed; she wanted us to succeed
- 2) he/she doesn't have a preconceived connotation of how things should be. He/she taught us that it is not black and white in life. He/she taught us to be open-minded and that there are lots of gray areas
- 3) he/she expects us to do our best; he/she push us to our best ability
- 4) he/she helped me build by own self-esteem in the subject matter
- 5) he/she reached us in a way that we were able to open up and express our opinions freely and creatively
- 6) he/she won't let me quit
- 7) took a personal interest in us

Classroom management

- 1) he/she knew how to take care of classroom problems if they occur (some students took advantage of the freedom given to us)
- 2) when conflicts occur in the classroom she knows how to take care of it and take charge of class

Climate

- 1) open discussions
- 2) we learned a lot
- 3) comfortable atmosphere
- 4) everyone achieves; that was his/her philosophy
- 5) freedom to express your opinion
- 6) he/she is organized. He/she is not lost and he/she doesn't make us feel we are lost, either
- 7) I never fell asleep in his/her classroom
- 8) lots of class and group discussions
- 9) lots of class discussions, debates, group discussions and projects
- 10) lots of humor in class

Teacher-student interaction

- 1) interested in us as individuals
- 2) easy to talk to
- 3) got you involved with other students
- 4) he/she encouraged us to go beyond
- 5) he/she is approachable
- 6) never embarrassing you in front of others
- 7) we didn't have to memorize; we understood the subject, instead
- 8) we felt very engaged

Student attitude

- 1) I feel I learned the material even though the book was hard to read
- 2) I looked forward to going to his/her class
- 3) it is easier for a teacher to promote creative thinking in an art class than in science or English class
- 4) you really cannot be creative in a science class. How could you?
- 5) English is English; how creative can you be?
- 6) Science is Science; how creative can you be? How creative can a student or a teacher be in an anatomy class?
- 7) he/she kept us waiting anxiously for the next thing he/she wanted to say in class

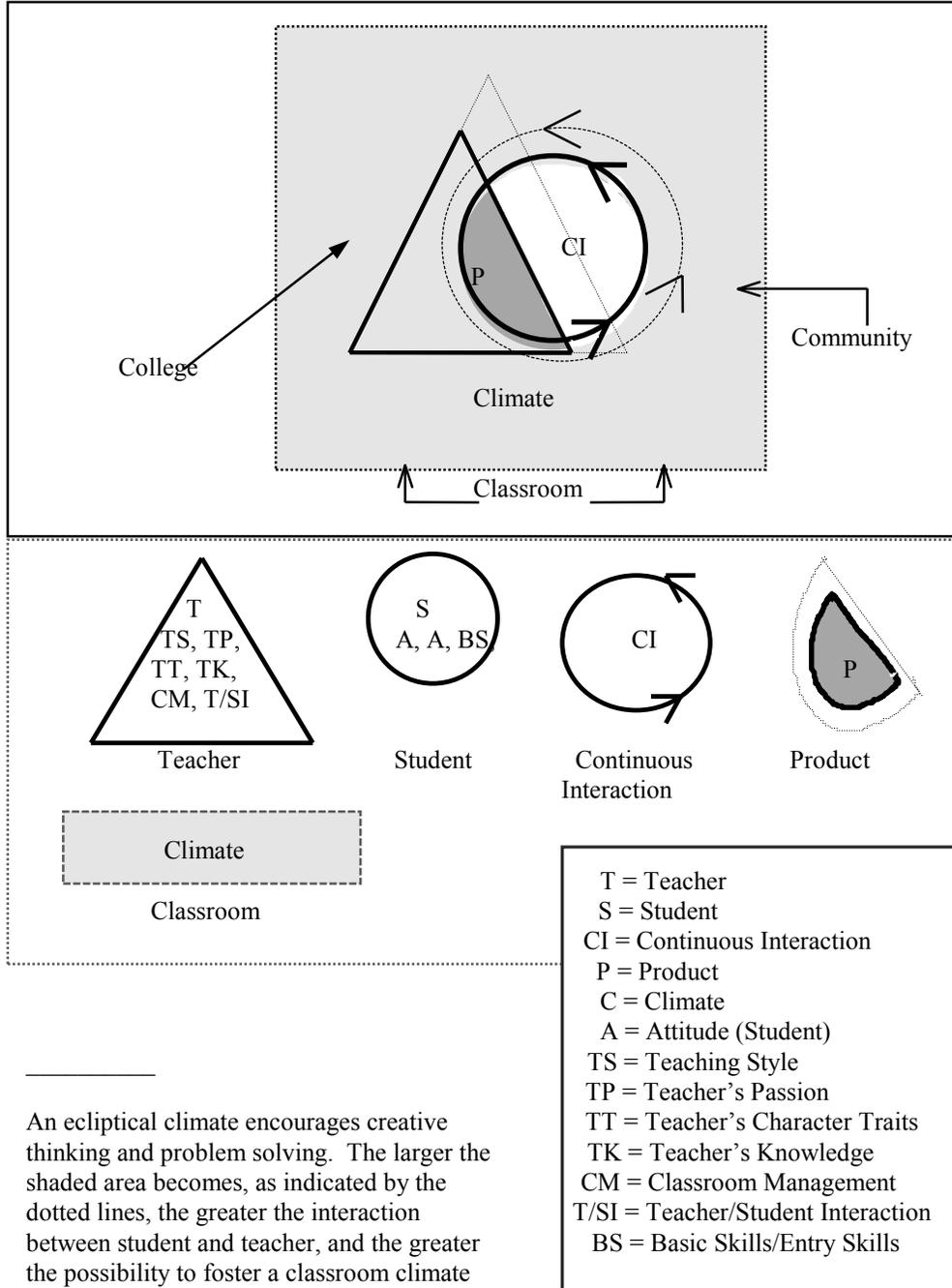
- 8) a community college education offers less creative thinking than a four-year college. They are supposed to since public schools graduate students who lack basic skills. How could they (community college) offer and promote creative thinking when students lack basic skills? A community college has to provide and build those basic skills in students before they promote creativity.

SURVEY OF ATTITUDES QUESTIONNAIRE

During each survey of student attitudes in observed classroom settings, the researcher asked students the following questions:

- Q1: What were some of the things about this class that you liked most?
- Q2: Has this teacher's class met your learning expectations? Why?
- Q3: Has this teacher's style of teaching, characteristics, and interaction with students been different from other teachers' style of teaching?
Please explain your answer.
- Q4: Do you feel that the activities you were engaged in through the semester has encouraged your thinking? Why?
- Q5: Briefly, can you describe for me how this teacher's classroom environment, teaching and the classroom interaction have affected your learning or your thinking experience during this semester? Please explain.

ECLIPTICAL INTERACTION



Creative problem solving (CPS) is a way of solving problems or identifying opportunities when conventional thinking has failed. It encourages you to find fresh perspectives and come up with innovative solutions, so that you can formulate a plan to overcome obstacles and reach your goals. In this article, we'll explore what CPS is, and we'll look at its key principles. We'll also provide a model that you can use to generate creative solutions. Alex Osborn, founder of the Creative Education Foundation, first developed creative problem solving in the 1940s, along with the term "brainstorming." And, together with Sid Parnes, he developed the Osborn-Parnes Creative Problem Solving Process. Despite its age, this model remains a valuable approach to problem solving. Creative Problem Solving Tools & Techniques Resource Guide. "We can all create a desired future instead of merely accepting what life offers." Sidney Parnes. Parnes partnered with Osborn beginning in the 1950s to develop methods for teaching creative thinking and problem-solving. After founding the Creative Problem Solving Institute, CEF sponsored, with Parnes and Noller teaching, the nation's first creative studies graduate courses at SUNY Buffalo State. Parnes' work focused on helping people learn and practice deliberate creativity in their personal and professional lives as well as in academic settings. This assemblage of tools and techniques represents the collective wisdom of many gifted and generous trainers, facilitators, and authors.