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#### Recommended Citation

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# Think-Pair-Share: Teaching Strategy Unravels Uncertainty

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**Abstract.** Think-Pair-Share and Uncertainty in general situations intersects several similarities with each other such as: thinking, communication, teamwork and creativity. Think-Pair-Share teaching strategy proceeds with three steps. Usually, it applies in all academic subjects; nonetheless, I employed it in algebra class when we analyzed open ended questions. As a teacher, I gave the question (real world situation question) to students, as a first step students read the question and analyzed the question individually. Second step, students paired in groups of four to five students; they discussed their thoughts (ideas how to solve the problem) about the question within their group. Step three, each group selects the best answer of their group; moreover, they share the answer with the class. Finally, students compared and contrast answers, then they evaluated the best answer that made a better sense (The best logical answer). Think-Pair-Share is closely related to uncertainty in new jobs. In the case, a worker faces an uncertain job; as a first step, he or she will think (analyze) the job. After the worker comes up with an answer, the worker will deliver the answer to other workers (to get a second opinion about the answer). Furthermore, all workers will share their ideas within the teamwork or company. Above all, workers with a consensus will select the best answers that might be practical during running their activities at the work- place.

**Keywords:** Think-Pair-Share (TPS), Uncertainty, Communication, Metacognition, Critical Thinking, Teamwork, Creativity, Teaching Strategy

## 1. Introduction

Teaching strategies centered on students rather than the teacher yields learning that targets entirely the concept of the subject. Several strategies that participate in collaborative teaching and learning are problem-based learning, inquiry-based learning, project-based learning, round table, jigsaw, concept mapping, Think-Pair-Share, type II teaching, etc. The paper will analyze the TPS and its relationship with the uncertainty. Using TPS technique applies by giving students a question/questions, and then they work on their own by reading the question and finding possible solutions or answers. Each student pairs in groups; they share their answers within the group, and they select the best one within their team. Lastly, each group presents the best answer at the class; next, students compare and contrast all answers. As a result they choose the best possible answers as a correct one if it satisfies all components of an accurate response.

Open ended questions do not have a right or wrong answer; nonetheless, every student should try to get a good one that makes sense. In the same way, when workers work with an uncertain job (they do not know the right or wrong answer), every worker tries to find a constructive working method or product similarly with TPS teaching/learning strategy. Based on the article, Learning from Each Other Bilingual Pairs Classroom Dual-Language claims, “This Think-Pair-Share strategy usually eliminates children’s uncertainty and fear that they may answer incorrectly in front of their peers (Alanis, 2011).” Similarly, workers do not know what is right or what is wrong when they deal with new jobs. The first step, workers think about solutions or right answers in uncertain jobs. Next, workers might find some answers, which needs to validate them by sharing their ideas within their teamwork. In addition, each team shares their findings within the company with the purpose to approve the best solutions.

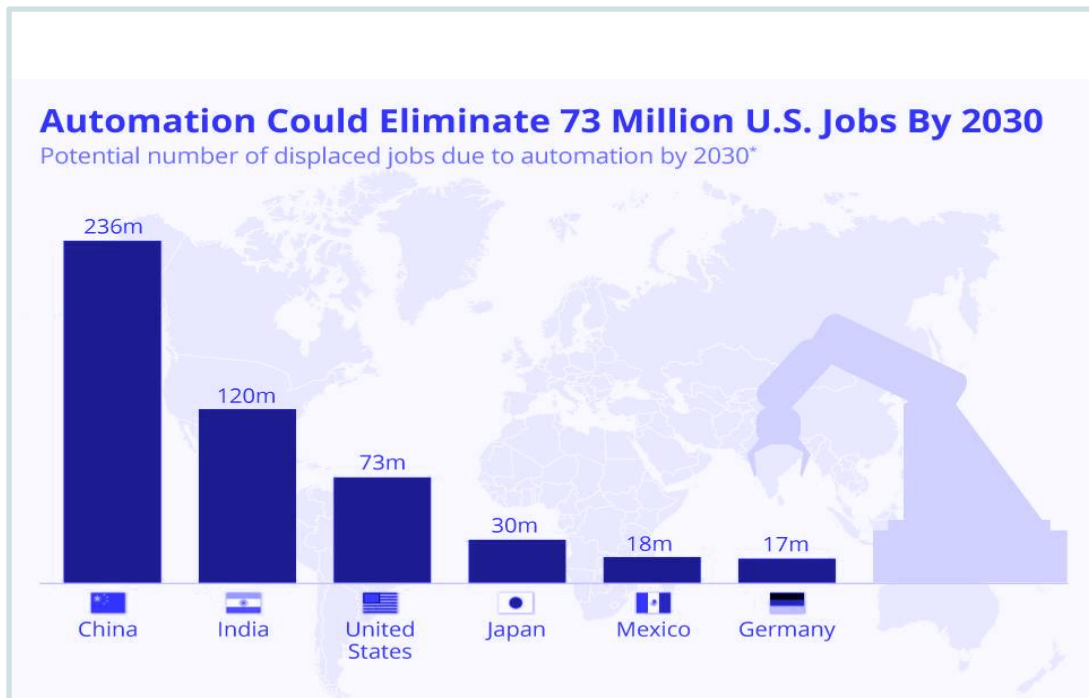
The Think-Pair-Share approach targets the best solutions in word problems and open-ended questions in mathematics; therefore, I utilized this technique while I was teaching at charter high school and public high school. The collaborating teaching performance does work better with accountable (responsible) students than with struggling students or students with low academic performance. Responsible students follow exactly given instructions on the paper; also, they respect rules consistently. The article, Who is Responsible for Student’s Learning? claims, “No matter how charismatic and engaging we are, how much technology we leverage, how many

classes we flip or how many pallets of rubrics we deploy, in the end, it's still the students who have to do the learning (Gilbert, 2018).” Responsible students engaged actively during the TPS, and usually they were creative with their answers.

## 2. Material and Methods

The modern education’s intention is to pay close attention to creative education that focuses on mathematical thinking rather than remembering the learning material. Based on the book, *Bringing Schools into the 21 st Century*, “The new focus of education is on an outcome of understanding and wisdom rather than the historical end-point of knowing and remembering ( Wan, Gut E, 2011).” New education’s ambition aims at the outcome of understanding that applies and deals with the unknown economic challenges. Economy and Education are interconnected with each other; economy advances the quality of education and vice versa. Recent economy grew much faster than previously with unpredictable economic challenges; development of the economy imposes an education that supports critical thinking and creativity as a response to dealing with uncertainty.

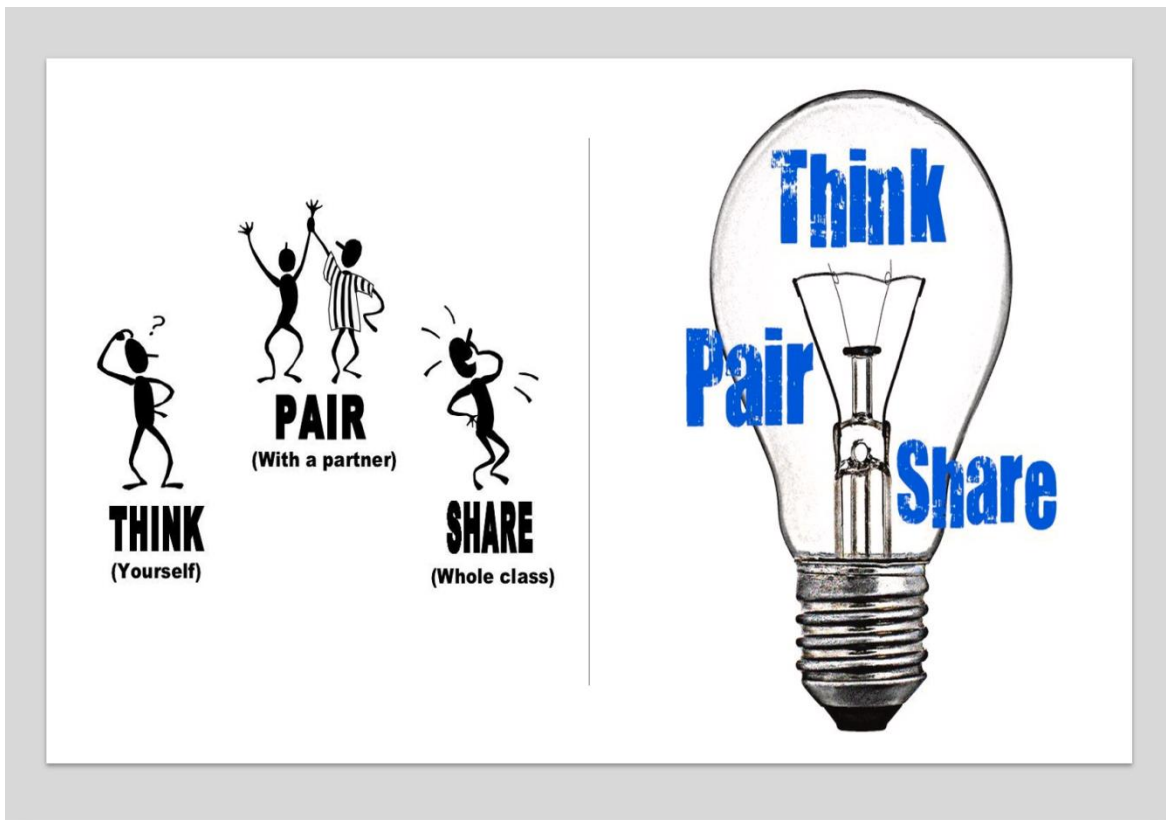
The rapid development of the economy sets the tone of uncertain new jobs and new teaching and learning strategies. Application of technology and science design new jobs with unfamiliar approaches and methods performing the task. Employees and employers should adjust with the innovative performances and recent jobs. On the other hand, education should employ new teaching and learning strategies that align with the new methods of workforce and innovation demands. In the twenty-first century uncertainty in the workplace appears in all segments of the economy; therefore, workers ought to be prepared to adapt to new situations. In addition, many jobs will not be able to last for a long time in their workplaces, so workers must find other jobs in different occupations. One aspect of the study is particularly noteworthy with regard to the significance of education. According to the article, *Consequences of Job Insecurity on the Psychological and Physical Health of Greek of Civil Servants*, “Perlman and Bobak found that education seemed to provide a protective factor against some indicators of unstable employment, independently of occupation (Dimitra Nella, Efharis Panagopoulou, December 2014).” When workers lose their jobs and find new jobs, usually the new job will obtain new unknown elements to them. In order for the workers to be ready on capturing new assignments, they should get the right training or adequate education. A method, which provides students with skills to face challenges with job uncertainty in the future is the Think-Pair-Share method.



**Fig. 2.1.** Automation could eliminate 73 million jobs by 2030 is taken from the article 21 st Learning Skills. Retrieved from [21st Century Learning Skills](#) .

Advancement of technology and science urges huge changes throughout any society; based on the data of the Figure 2.1 automation could eliminate enormous numbers of jobs by 2030 compels workers to find new jobs most likely with different occupations. Another probability might happen the new jobs demand new skills with global network, According to the article, Exploring the Intersection of Science Education and 21- st Century Skills (a workshop summary), claims, “De Rocco argued that companies whose workforces lack the 21 century skills are at disadvantage at dealing with such as challenges of converging technologies and manufacturing and need quickly move new product to the market to beat intense global competition ( Hilton, 2010).” This is a reason why employees and employers need to get a better education that equips them with the necessary skills in the twenty-first century. New skills incorporate adaptability, complex communications skills, complex problem solving skills, etc.

Nowadays, teachers apply various teaching strategies, which differs greatly from traditional teaching, and complies with modern education. The teaching strategies centered on students such as problem based learning, inquiry based learning, project based learning, According to the article, To work, the 21st century skills movement will require keen attention to curriculum, teacher quality, and assessment, “Most teachers don’t need to be persuaded that project-based learning is a good idea—they already believe that ( Rotherham and Wilingham, 2009). ” Most of the teachers apply the problem based learning in the classroom at least partially because they know students become more independent. In addition, teachers play the role as facilitators, which makes the teaching job much easier with a greater benefit.



**Fig. 2.2.** Think-Pair-Share leads to Brainstorming. The figures are taken from Mantra 4 change and look out for Learning.

. Project based learning requires students to solve real world examples by teacher’s assistance when necessary; in other words it is a cooperative learning strategy. Similarly, teachers might apply Think-Pair-Share

teaching strategy. According to the article, *An Exploratory Study on Using the Think-Pair-Share Cooperative Learning Strategy*, “The cooperative learning strategy of Think-Pair-Share fostered a classroom learning environment with better affect among student groups (Kwok and Lau, 2015).” Cooperative learning impacts significantly on incrementing the communication skills and supplementing with auxiliary interpretations. At the same time as students agree or disagree with responses on the questions, they observe assorted descriptions. The Think-Pair-Share strategy has similar application with the Problem Based Learning strategy.

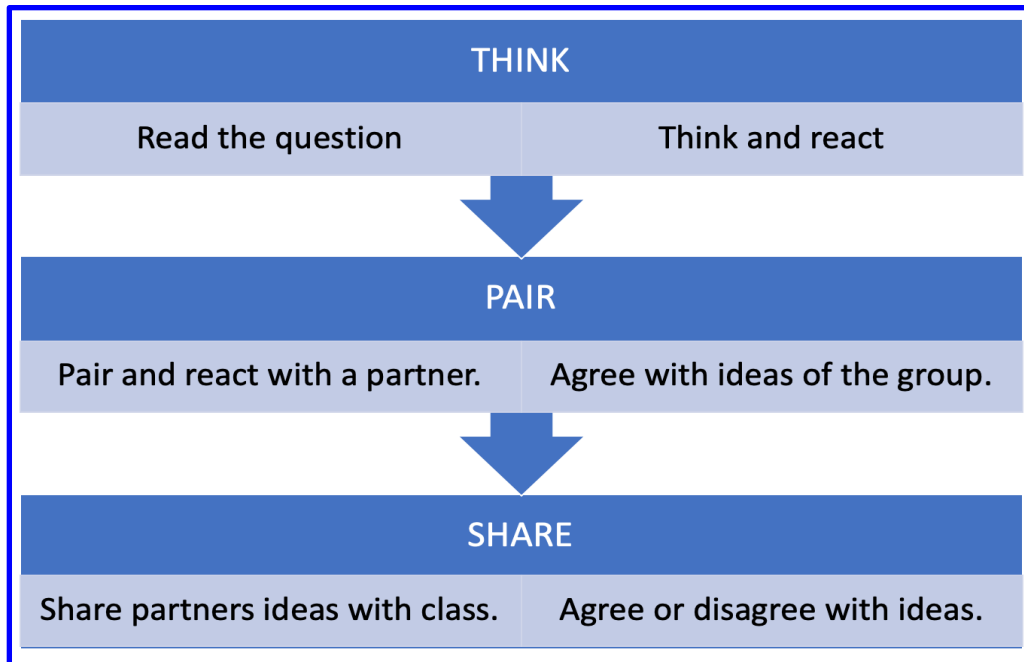
Professor Frank Lyman, at University of Maryland created the teaching strategy Think - Pair - Share. Application of Think-Pair-Share strategy requires math teachers to incorporate at least an open ended question in the lesson plan, and they will ask students to come up with their answers. First of all, students will have a considerable amount of time to think about questions. Moreover, students will work in pairs and shortly they share their answers within their group. Lastly, each group of students share their results/answers with the whole class. The goal of the strategy is to engage students to deal with the unknown and participate actively in the classroom by sharing their thoughts with the class during a session. “Research has shown that cooperative learning increases students’ understanding and ability to integrate and synthesize new material” (Sampsel, 2013). During the Think-Pair-Share students exchange their learning or understanding more because they can compare their responses with others, and they complement each other’s interpretations. Learners combine different ideas with each other, and sometimes they come up with conjectures or new interesting findings.

Think-Pair-Share strategy enables students to deal with uncertainty in any company when they get to work in the near future. Nonetheless, some companies demand suitable work in uncertain jobs with perfect outcomes. The book, *The Limits to Certainty, Programmed of Research on the Economics of Services* claims, “Intuition suggests that modern societal and economic development depend not so much on achieving perfect deterministic and sure objectives, but rather on developing creative activities in a world where uncertainty, probability and risk are given conditions, productive of real opportunities and choice ( Giarin and Stahel, 2012).” The competition in sophisticated and advanced economic societies compels the progress of innovations in contemporary companies. Accordingly, teaching and learning aims at application of educational creative strategies. A pragmatic teaching approach that covers elements of creativity is Think-Pair-Share; likewise , it satisfies demands for uncertainty jobs of the future workforces.

### 3. Method

The application of Think-Pair Share, as stated in Figure 3.1, is a cooperative teaching/learning strategy; the teacher gives a question to the students; moreover the job of the students is to figure out the answer by cooperating with their group. Based on the article, *The Use of Think Pair Share Technique in Teaching Reading to the Seventh Grade of Senior HighSchool*, “Cooperative learning is one of strategy that divide students into small groups from which students engage in learning activities using structures designed to require each group member to contribute with the assistance and encouragement of other team members (Lia Yulianingsih, 2017)” First of all, students will work in his own by applying the first step THINK. Every student ( individually) reads the questions and analyzes silently for a short period of time; and then, thinks and reacts to the question by getting a probable answer. Next, students will PAIR with the partner/partners in the small groups; meanwhile, they will discuss their probable answer within their group in the details. In this process, students will compromise or agree with an answer that they think is closer to the optimal answer. Finally, students will SHARE their ideas with the class and discuss in the detail the declared answers. At the same time, students may agree or disagree with the answers along with offering their reasonable kickback.

The teaching cooperative strategy, Think-Pair-Share, might be used at most an hour per week in any subject. As a math teacher, I use it sometimes when we analyze word problems or open-ended (word real problems) questions in mathematics. The article *How to Use Think-Pair-Share Activity in Your Classroom* claims , “Make use of the Think-Pair-Share strategy when dealing with word problems. These complex situations can sometimes be difficult for young children to grasp, and this strategy can help your students work together to find the correct answer (Tania K. Cowling, n.d)” Teacher’s interpretations of a word problem responses for some students is complex, so they might not understand thoroughly the given open ended example. Nonetheless, when students understand a question, respectively, when they find the answer, students understand each other's interpretation much more easily than teachers’ description with a rich vocabulary.



**Fig. 3.1** The process of Think-Pair-Share strategy in the three steps. Is modified from Teacher by Teacher.

My studies with the cooperating learning strategies, practically I did in my class by direct observation of my students' results while I applied TPS strategy at Ilearn School and STEM ACADEMY Highschool in NJ. I gave clear instructions on how to work and answer the math word problem. The time period was fifty-minutes, and we calculated the given time for applying the whole process of TPS along with the class period. The article, Wait Time and Rewards as Instructional Variables claims, "Students get time to think critically, creating a learning environment that encourages high quality responses (Rowe, 1972)." The open-ended questions do not have just one specific answer; therefore, students are not afraid to face the unknown questions since there is no right or wrong answer. They take any question with confidence and responsibility to analyze possible responses. Sometimes creative ideas hide inside the nonsense explanations, but by exploring every possible solution students come up with impressive and new ideas. Think-Pair-Share gives students an opportunity to get outside their comfort zone and deal with any unknown questions and situations.

The curriculum of Ilearn schools NJ integrates Think-Pair-Share strategy in all subjects. Implementing the Think-Pair-Share strategy is not easy, so they practice how to apply this strategy step by step. Teachers should know how to address the questions and how much time to give students. Children should be prepared how to work collaboratively and face uncertain questions. According to the book leapfrogging inequality, "Children will need to be well equipped to face uncertainty, and to, among other things, work collaboratively with others to solve problems—a skill seldom taught in the average school ( Winthrop, Barton, & MCGivney , 2018)." Ilearn schools are Innovative schools where average students are relatively well equipped to continue education in college. The significant factor on student's success at Ilearn schools is to deal with uncertainty at the more advanced studies or new jobs relies on using the Think- Pair-Share strategy.

Despite the fact a minute percentage of students were ready to adjust to collaborative learning, several supervisors thought the TSP approach should be applied all the time. The downside of the students at Ilearn School was that a great percent of students were not ready for the TPS. The article CELTs: Supporting Collaborative Activities Among Students and Teachers Through the Use of Think Pair Share Techniques claims, "Every student should be prepared for the collaborative activities; working with pairs, brainstorming ideas, and sharing their thoughts or solutions with the rest of the collaborators ( Azlina, 2010)." Every student at Ilearn school was not prepared to work individually and then share ideas with their group or the class. As a result, I applied the collaborative technique usually when it was the word problems in math or when we applied mathematical examples in the real world situations.

In my teaching experience at STEM Academy, I applied TPS strategy and I observed students activity there. In the first two months, I applied this strategy during every period. At this time my students were more

prepared than in Ilearn school, and it was easy applying the TPS because students were responsible about their learning. The research, *Disciplinary Literacy Strategies – Think-Pair-Share and Variations*, states, “Think-Pair-Share encourages student participation from all students and promotes individual and peer accountability” The class was divided in groups of four or five and in the beginning I gave them maximum two questions. Students needed more time to digest the information, and then proceed with the next steps. Students explored questions in the details by sharing responses with the others and they tested various responses; in addition, they were thoughtful (responsible) while they selected their correct answers (the one that is the best fit).

#### 4. Results

While I was applying the collaborative method, students’ took a longer period of time to analyze and refine the answers. The three steps of the process reduced the length of the time to include a greater number of examples (questions). Based on the article, *Effects of Guided Discovery and Think-Pair-Share Strategies on Secondary School Students’ Achievement in Chemistry*, “The “think time” incorporates the important concept of “wait time.” It allows all children to develop answers, longer and more elaborate answers can be given, and answers will have reasons and justifications because they have been thought about and discussed (Bam iro, 2015).” The greater time students spend on analyzing (studying) the question, the greater is the opportunity to comprehend effectively the lesson. The relationship of time and learning outcome is described in the figure 4.1. The learning outcome is a function that depends on the length of the time. The time to process all necessary information of the question and attempt to find a solution or an answer reflects on the positive learning outcome.

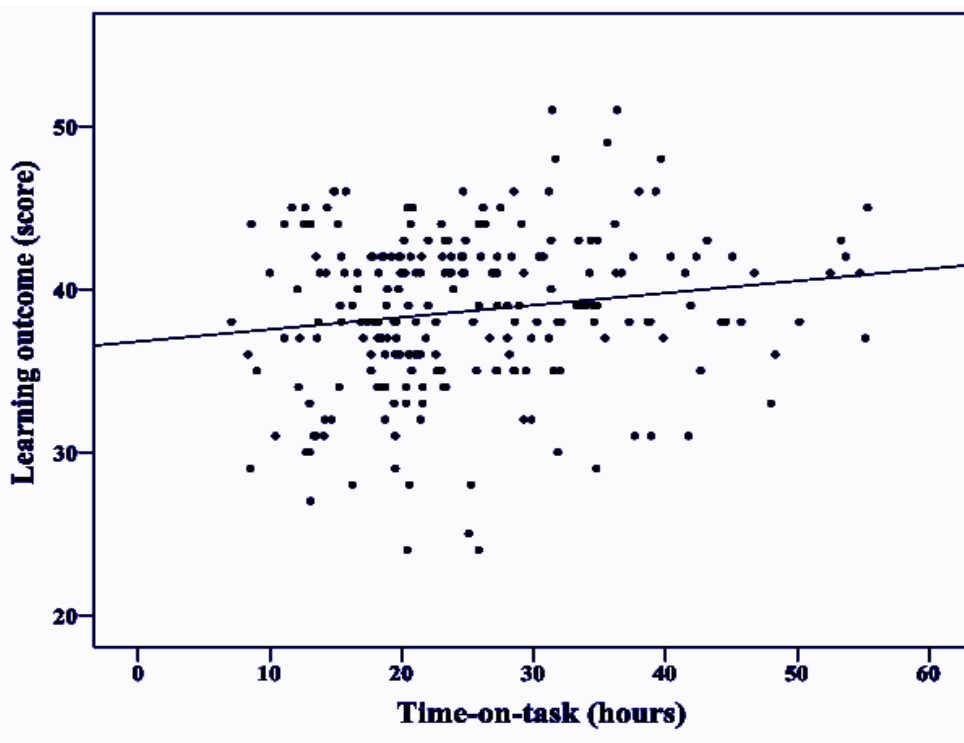
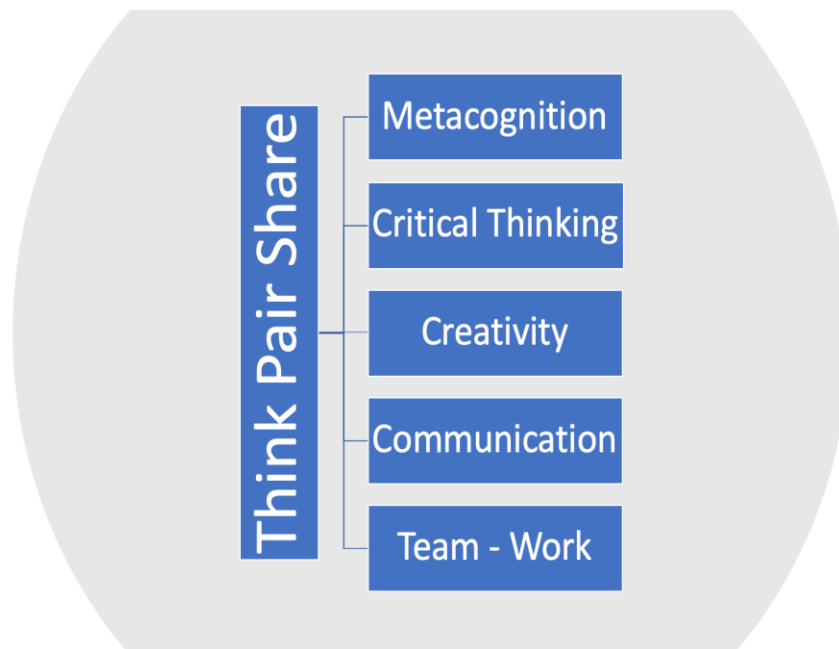


Fig. 4.1 uploaded by Marc Egloffstein online: Relationship between learning outcome and time on task.

Metacognitive process is an activity when a student (or an individ) thinks about his/her own thinking; in addition, this process is closely related with the TPS strategy. Metacognition enables students to reflect on their own answer and compare with others’ answers when they work collaboratively. The article, *Promoting Student Metacognition* claims, “For example, during in-class pair discussion of a clicker question, the direction to not only compare chosen answers with a colleague but also to pose one question that relates to something you found

confusing about the question could immediately increase the willingness and comfort level of students to discuss confusion, which demands them to be metacognitive during the activity (Tanner, 2012).” While students reflect on their answers, they might find a possible flaw there, and they may address the issue to the group, and dive deeper with analysis of the question. In the case they cannot find an appropriate answer or solution to the given question, they would discuss with the whole class until they are satisfied with the result.

Collaborative learning enhances critical thinking significantly because students compare and contrast various answers to a single question. In some cases, a single answer did not have a complete content; therefore, the combination of two or more students’ answers produced a best, complete, and achievable one. According to the article, Think Pair Share: One Teaching Learning Strategy to Enhance Students’ Critical Thinking, “Based on the findings of this study, Think-Pair-Share was a strategy that contributed to the improvement of CT, analysis, argument, patriotization, problem, solving and resolution skills (Mahmoud, 2013).” When my students work on groups, they give their best effort by exploring the topic from numerous angles. Inspecting the question from multiple perspectives provided students with various answers from the simple answer to a complex one. Selecting the best accurate answer within a student group, respectively the class definitely led to students’ critical thinking skills. Usually the best answers contained interesting content that were accepted as an accurate one by the majority of students.



**Fig. 4.2** The relationship between the Think-Pair-Share and metacognition, critical thinking, creativity, communication, and team-work; all five factors are also closely related to uncertainty at any situation.

Facilitating the lesson by using the TPS strategy, students are not certain how to get the right answer; they have to get out of their comfort zone and they have gotten satisfactory results in the questions of the algebra class. Creativity and uncertainty played crucial roles during the collaborative teaching strategy. Based on the article, Kick Starting Creativity: Supporting the Productive Faces of Uncertainty in Information Practice, “The desire to explore these findings further led to the present examination of the link between uncertainty and creativity (Anderson, 2010).” Sharing answers in the class led students to seek for the optimal answer. Students provided multiple answers for a single question without being afraid of the wrong or right answer; some of the responses were incomplete and others were closer to the correct answer. It was necessary to mix answers and complement each other, and then we came to the answer that made a better sense.

The key component of analyzing word problems in mathematics and modeling the real-world situation takes part at communicating various statements. The Pair and Share actions urges classmates to share ideas intensely



with each other until they find a satisfactory solution. The article, *The Impact of Employing the (Think - Pair - Share) Strategy to Gain Some Number Sense Skills and Mathematical Communication*, states, "...cooperative and group work between students, helping to make the student an effective and active element in the classroom, which is the essence of the development of mathematical communication and number sense skills (Farrajallah, 2016)." Students communication during the algebra class provided students with a better mathematical vocabulary and confidence to express their ideas in front of a larger audience. Communication enabled them to comprehend the question or confusing elements better by communicating with their peers or teacher. Above all, communication significantly improved students' skill to translate word problems into mathematical statements.

Obviously, the given question did not equip students with enough information; therefore, their classwork demanded greater teamwork. Each student has weaknesses and strength; teamwork was a powerful tool to turn weakness into strength. According to the article, *Group Work: Using Cooperative Learning Groups Effectively*, "Cooperative learning follows this idea as groups work together to learn or solve a problem, with each individual responsible for understanding all aspects (Brame, Biel, 2015)." Even the best student in the class did not have the complete solution of an open ended problem. Some students who understood more aspects of the question offered a greater contribution to the class, others offered a less contribution. Nonetheless, the quest for the best answer (blended all answers together) of teamwork offered a great opportunity to learn one from another when we applied the TPS strategy.

## 5. Discussion

Correlation between the Think-Pair-Share and Uncertainty is inevitable if we make a parallelism between the elements in the figure 4.2 and the Figure 5.1, we might see clear similarities of these two concepts. Similarity between uncertainty and TPS is reflected at least in the relevant factors (Figure 5.1) reflection/thinking, communication, teamwork, and creativity. We have already seen these constituents in the TPS; now, we will discuss them in the terms of uncertainty. When workers face an unknown job, the first step they take is think and reflect on the ways to deal with the unpredictable challenges. After awhile they will come up with some ideas that are not sure. Based on the article, *Communication, Concept, Practice and Challenges*, "Communication conveys complex, sensitive and controversial information (Munodawafa, 2008)." Uncertainty might impart new controversial and incomplete information, which is imperative of assessing with a larger group. The consistent work produces great results on different occasions when workers operate as a team. Usually, teamwork and candid communication determine effective outcomes in general cases or in most cases when there are uncertain jobs involved.



**Fig. 5.1** The relationship of the uncertain job with few significant factors such as: Reflection/thinking, Communication, Teamwork, and creativity.

Communication in teamwork during uncertain jobs gravitates towards a unique goal of understanding the routine of the work and familiarizing with the risk outcome (loss/gain). The magnitude of any average or great

company contains various workers/teamwork who perform particular jobs. Regarding the article, Developing Effective Communication Skills, “Everyone on the team should be empowered to work toward the goal in his or her own job, in addition to contributing ideas for the team as a whole (Practice 2007).” Everyone in the team has a distinct job that dictates a specific conduct and different approaches. Some of them might have better ideas to perform the new job than the others; blending ideas together by communication produces advanced methods that fit better at the workplace for all.

Workers’ endeavor with new ideas about the uncertain (new) jobs reflects new methods or actions to operate at the workplace. The new approaches or working strategies results as a product of creative activities and necessity. The article, At the Heart of Creativity; Curiosity, and Uncertainty, claims, “No matter what realm you work in: creativity will involve facing an uncertain moment (or, more likely: moments) (Christensen, 2014).” Recently, the development of the economy has given rise to new jobs, which contain uncertain techniques on new jobs; workers must be prepared on dealing with the unknown at every moment and find solutions to conform circumstances and activities at the workplace. Oftentimes, workers’ solutions obtain beneficial outcomes for their company and broader.

As I mentioned earlier, uncertainty deals with many factors, but I paid attention only to the factors that are closely related with the TPS factors. In general, uncertainty at the workplace indicates unreliable data, methods, activities, outcomes, risks, etc. the specific work that deals with uncertainty has specific unreliable working components. For instance, working with ecological issues of uncertainty factors (risk factors) are related with the particular situation. According to the article, A critical evaluation of safety (uncertainty) factors for ecological risk assessment, “Uncertainty factors are used most frequently in ecological risk assessments that use the indicator species approach (Chapman, Fairbrother, Brown, 2009).” Nonetheless, in my paper I talked about how workers deal with the unknown in general situations. First of all, when workers face uncertain jobs, they will think about what strategy or method might be suitable and safe. Next, they will communicate their findings with other workers, respectively with supervisors to test new ideas. Moreover, all workers will share their thoughts in the teams and within the company. Above all, they will test the best practical ideas; furthermore, the company will accept sublime creative ideas of its organization with a unanimity.

## 6. Conclusion

The well-known expression, “Does not exist a magic stick that empowers a perfect teaching and learning technique.” is apparent to all teaching staff; hence, educational researchers examine various gratifying teaching techniques. Several significant teaching methods are as follows: problem based learning, inquiry based learning, project based learning, multiple choice strategy, true/false strategy, match exam strategy, problem solving strategy, etc. Every teaching approach has its positive and negative sides. For instance, teaching strategies for standardized tests (multiple choice tests) in mathematics have shortfalls with critical thinking and creativity. The article, Standardized Tests and Measuring Critical Thinking Abilities says, “Just as importantly, many people, from administrators to educators to parents, have questioned how the growing number of standardized tests gets in the way of teaching students important deeper thinking skills (Mentoring Minds, 2014).” Teaching strategies for standardized tests use specific methods reliable on framing a short time for each question. Usually, working time on each question approximates around five minutes. Each lesson should address at least ten questions per a class period. On the other hand, Think-Pair-Share utilizes one or two questions throughout a class period for at least forty minutes.

The bad side of the Think-Pair-Share analyzes a limited number of examples in mathematics with respect to time. Results in Figure 4. 1 verifies the evidence of the relationship of time and learning outcome. The more time is spent on Learning, the greater is students’ understanding. The article, The Effective Mathematics Classroom, states, “In general, a *best practice* is a way of doing something that is shown to generate the desired results. In terms of mathematics instruction, we typically think of a *best practice* as a teaching strategy or lesson structure that promotes a deep student understanding of mathematics (n.d).” When students started the real word problem to read and think how to translate it to the mathematical statement without step by step instructions, practically they analyzed like researchers. Students dealt with uncertainty because they had to figure out key words in the word problems and relate them to the mathematical equations that they were familiar with. The good side of TPS is the procedure drives over multiple steps prior to the final solution; therefore, students employ from lower to higher order thinking skills within an open-ended problem or two.

Modern education in the Twenty-First Century incorporates multidimensional teaching instructions to satisfy students’ academic progress. Blending assorted instruction in contemporary education encompasses a well

rounded student outcome. Every teaching approach has effective results in an active teaching. The article, Learning by Doing: An Empirical Study of Active Teaching Techniques, states, "The current findings indicate that each teaching technique has its own unique benefits and is effective for various types of learning (Hackathorn, Solomon,...., 2011)." There are plenty of documents on several teaching strategies that prove the positive results. The TPS is an active teaching technique for modern education in the Twenty-First Century.

In my observation during application of the TPS in my class, I have seen a close relationship of the TPS and Uncertainty as the paper elaborates in the details. When students tackled the question that they accessed in the beginning of the class, they were challenged with the uncertainty in all aspects. They were not sure about the answer, neither they were sure what techniques to use and how to model the real world problems inspected with the perspective of mathematics. Correspondingly, rapid development of the economy innovates new jobs that generates uncertainties to the workers performing their regular jobs. Uncertain jobs demand from workers the same strategy as Students' strategy when they use the TPS technique dealing with the question. Because the interaction of the TPS and Uncertainty have an apparent correlation with each other, it winds up the TPS is a powerful tool preparing students for the future workforce to face challenges of uncertain jobs in the Twenty-First Century.

## REFERENCES

1. Abdel-El-Karrim Farrajallah, (December 31, 2016), The Impact of Employing the (Think - Pair - Share) Strategy to Gain Some Number Sense Skills and Mathematical Communication Skills Among Fifth Grade Students, An - Najah Univ. J. Res. (Humanities). Vol. 31(9), 2017, [https://www.researchgate.net/profile/Abdlkareem\\_Farajallah/publication/329528843\\_athr\\_twzyf\\_astratyjt\\_fkr\\_zawj\\_shark\\_fy\\_aktsab\\_bd\\_mharat\\_alhs\\_alddy/links/5c0e370e92851c39ebee1fdc2/athr-twzyf-astratyjt-fkr-zawj-shark-fy-aktsab-bd-mharat-alhs-alddy.pdf](https://www.researchgate.net/profile/Abdlkareem_Farajallah/publication/329528843_athr_twzyf_astratyjt_fkr_zawj_shark_fy_aktsab_bd_mharat_alhs_alddy/links/5c0e370e92851c39ebee1fdc2/athr-twzyf-astratyjt-fkr-zawj-shark-fy-aktsab-bd-mharat-alhs-alddy.pdf)
2. Adekunle Oladipupo Bamiro, (January 19,2015), Effects of Guided Discovery and Think-Pair-Share Strategies on Secondary School Students' Achievement in Chemistry, doi.org/10.1177/2158244014564754 , retrieved from, [Effects of Guided Discovery and Think-Pair-Share Strategies on Secondary School Students' Achievement in Chemistry - Adekunle Oladipupo Bamiro, 2015](#)
3. Andrew P. Kwok, Alexandria Lau, (2015), An Exploratory Study on Using the Think-Pair-Share cooperative Learning Strategy, Journal of Mathematical Sciences 2 (2015) 22-28 Betty Jones & Sisters Publishing, retrieved from [Java Based Distributed Learning Platform](#)
4. Andrew. J Rotherham and Danella Wilingham, 2009 ,To work, the 21st century skills movement will require keen attention to curriculum, teacher quality, and assessment, Educational leadership, retrieved from [Sept cover\\_875pmsCXN.indd](#)
5. Ariana Sampsel, Finding the Effects of Think-Pair-Share on Student Confidence and Participation, 4/29/2013, Bowling Green State University retrieved from [Finding the Effects of Think-Pair-Share on Student Confidence and Participation](#)
6. Carss Wendy Diane, 2007, The Effect of Using Think - Pair - Share During Guided Reading Lessons, retrieved from [The Effects of using Think-Pair-Share during Guided Reading Lessons](#)
7. Cynthia J. Brame, Rachel Biel, (2015), Group Work: Using Cooperative Learning Groups Effectively, Center for Teaching, Vanderbilt University, retrieved from, [Group work: Using cooperative learning groups effectively](#)
8. Davison Munodawafa, (June 01, 2008), Communication: Concept, Practice, and Challenges, /doi.org/10.1093/her/cyn024 retrieved from, [Communication: concepts, practice and challenges† | Health Education Research](#)

9. Dimitra Nella, Efharis Panagopoulou, Nikiforos Galanis, Anthony Montgomery, and Alexis Benos, (December 22, 2014), Consequences of Job Insecurity on the Psychological and Physical Health of Greek of Civil Servants Volume 2015 , Article ID 673623 , 8 pages, retrieved from [Consequences of Job Insecurity on the Psychological and Physical Health of Greek Civil Servants](#)
10. Eric Gilbert, (October 2, 2018), Who is Responsible for Student's Learning, retrieved from, [Why students should take more of a lead in their own learning \(opinion\)](#)
11. Guofang Wan, Diane M. Gut Editors, 2011, Bringing Schools into the 21 st Century, Springer Dordrecht Heidelberg London New York,
12. Kaddoura Mahmoud, Jun 2013, Think Pair Share: A Teaching Learning Strategy to Enhance Students' Critical Thinking, v36 n4 p3-24, retrieved from [EJ1061947 - Think Pair Share: A Teaching Learning Strategy to Enhance Students' Critical Thinking, Educational Research Quarterly, 2013-Jun](#)
13. Kimberly D. Tanner, (Summer 2012), Promoting Student Metacognition, doi: 10.1187/cbe.12-03-0033 retrieved from [Promoting Student Metacognition](#)
14. Iliana Alanis, (11 01, 2011), Learning from Each Other Bilingual Pairs Classroom Dual-Language claims, Dimension of Early Childhood, Vol 39, N01, 2011, retrieved from, [https://resources.finalseite.net/images/v1529612434/highlineschoolsorg/jobhktpl44kgeuniwoci/Learning\\_From\\_Each\\_Other\\_1.pdf](https://resources.finalseite.net/images/v1529612434/highlineschoolsorg/jobhktpl44kgeuniwoci/Learning_From_Each_Other_1.pdf)
15. IQ-MS Research Project, Disciplinary Literacy Strategies – Think-Pair-Share and Variations, retrieved from [Think-Pair-Share and Variations Think-Pair-Share \(Frank Lyman, et al, 1981\) is a collaborative discussion strategy designed to](#)
16. Jana Hackathorn , Erin D. Solomon , Kate L. Blankmeyer ,Rachel E. Tennial , and Amy M. Garczynski, (2011), Learning by Doing: An Empirical Study of Active Teaching Techniques, *The Journal of Effective Teaching, Vol. 11, No. 2, 2011, 40-54*, retrieved from, <https://files.eric.ed.gov/fulltext/EJ1092139.pdf>
17. Journal of Oncology Practice, (2007), Developing Effective Communication Skills, doi: [10.1200/JOP.0766501](#), retrieved from, [Developing Effective Communication Skills](#)
18. Lia Yulianingsih, (september 2017) Lia, The Use of Think Pair Share Technique in Teaching Reading to the Seventh Grade of Senior HighSchool, Academic Journal PERSPECTIVE: Language, Education and Literature Vol 5(2), retrieved from <https://pdfs.semanticscholar.org/9bf4/527ade86afe003808d0d87fb8059092b22fe.pdf>
19. Look out for Learning retrieved from [Tag Archives: Think Pair Share](#)
20. Mantra 4 Change retrieved from <https://mantra4changeblog.wordpress.com/2017/12/11/think-pair-share>
21. Margaret Hilton, Repertuar, 2010, Exploring the Intersection of Science Education and 21- st Century Skills (a workshop summary), The National Academy Press, Washington, D.C. [www.nap.edu](http://www.nap.edu)
22. Mentoring Minds, (January 16, 2014), Standardized Tests and Measuring Critical Thinking Abilities, retrieved from, [Standardized tests and measuring critical thinking abilities](#)

23. O. Giarin W. R, Stahel, 2012, The Limits to Certainty, Programme of Research on the Economics of Services, Geneva, Switzerland, Springer Science & Business Media, B. V.
24. N. A. Nik Azlina, September 5, 2010, CELTs: Supporting Collaborative Activities Among Students and Teachers Through the Use of Think Pair Share Techniques, retrieved from [CETLs : Supporting Collaborative Activities Among Students and Teachers Through the Use of Think- Pair-Share Techniques](#)
25. Peter M. Chapman, Ana Fairbrother, Derek Brown, (26 October, 2009), A critical Evaluation of Safety (Uncertainty) Factors for Ecological Risk Assessment, doi.org/10.1002/etc.5620170112 retrieved from, [A critical evaluation of safety \(uncertainty\) factors for ecological risk assessment](#)
26. Rebeca Winthrop, Adam Barton, Eileen Mcgivney, June 5, 2018, Leapfrogging Inequality, Remarking Education to Help Young People Thrive, Brooking Institutions Press.
27. Rowe, M. (1972). Wait time and rewards as instructional variables: their influence on language, logic and fate control. Retrieved from <https://eric.ed.gov/?id=ED061103>
28. Tania K. Cowling, How to Use Think-Pair-Share Activity in Your Classroom claims, retrieved from [How to Use the Think-Pair-Share Activity in Your Classroom](#)
29. Tanner Christensen, (october 3, 2014), The article, At the Heart of Creativity; Curiosity, Retrieved from, [At the heart of creativity: curiosity and uncertainty — Creative Something](#)
30. Teachers by Teachers retrieved from, Think,Pair,Share Poster for class. retrieved from <https://www.teacherspayteachers.com/Product/Think-Pair-Share-Poster-for-the-Classroom-and-Record-1513175>
31. The Effective Mathematics Classroom, retrieved from, [The Effective Mathematics Classroom](#)
32. Theresa Dirndorfer Anderson, (12 04, 2010), Kick Starting Creativity: Supporting the Productive Faces of Uncertainty in information Practice, retrieved from [Kickstarting creativity: supporting the productive faces of uncertainty in information practice](#)
33. Tobias Karner, Marc Egloffstein, Florian Binoder, Clemans Frotschi, (december 2015), Workload, time-on-task, and learning outcome in online learning for beginning students, DOI: 10.3217/zfhe-10-04/1, retrieved from, [\(PDF\) Workload, time-on-task, and learning outcome in online learning for beginning students](#)