

Enhancement of Higher Order Thinking Skills among Teacher Trainers by Fun Game Learning Approach

Malathi Balakrishnan, Gananathan M. Nadarajah, Saraswathy Vellasamy, Evelyn Gnanam William George

Abstract—The purpose of the study is to explore how the fun game-learning approach enhances teacher trainers' higher order thinking skills. Two-day fun filled fun game learning-approach was introduced to teacher trainers as a Continuous Professional Development Program (CPD). 26 teacher trainers participated in this Transformation of Teaching and Learning Fun Way Program, organized by Institute of Teacher Education Malaysia. Qualitative research technique was adopted as the researchers observed the participants' higher order thinking skills developed during the program. Data were collected from observational checklist; interview transcriptions of four participants and participants' reflection notes. All the data were later analyzed with NVivo data analysis process. The finding of this study presented five main themes, which are critical thinking, hands on activities, creating, application and use of technology. The studies showed that the teacher trainers' higher order thinking skills were enhanced after the two-day CPD program. Therefore, Institute of Teacher Education will have more success using the fun way game-learning approach to develop higher order thinking skills among its teacher trainers who can implement these skills to their trainee teachers in future. This study also added knowledge to Constructivism learning theory, which will further highlight the prominence of the fun way learning approach to enhance higher order thinking skills.

Keywords—Constructivism, game-learning approach, higher order thinking skill, teacher trainer.

I. INTRODUCTION

2^{1st} century learning is widely discussed among educators in almost every education conference and forum. The main objective of education in most countries is to prepare its citizens for the challenges of life. From this perspective, one of the aims of education is to enhance individuals with effective problem-solving and critical thinking skills. Hence, the educational process used to develop critical thinking in teacher candidates must be able to emphasize this. It has been highlighted through numerous studies that a large proportion of what teachers teach is what they have learned. Therefore, it is imperative to impart the knowledge of sound yet creative teaching techniques in critical thinking skills [1]. Higher order

thinking skill is essential and relevant to educate students of the 21st century who face complex real-life problem, which often deem complex solution [2]. Education systems in most of the countries are using HOTS as the main components to develop students who are critical and creative in thinking and are on par globally.

It is vital for teachers to be knowledgeable and skillful in their subject matter so that they will be able to equip students with the skills they need for future success [3]. Thus, teachers should equip themselves with skills and approaches on how to incorporate higher order thinking skill into their teaching and learning process. One of the ways to do it is by engaging students in critical thinking [4]. The teacher plays the role as a facilitator to allow for discussion and encourage a freer thought process. Teacher should encourage learning as it enhances the thinking skill of the students and is applicable in problem solving [5]. The educational process to develop critical thinking dispositions of teacher trainers is known to be important for the preparation of educational environments. The teacher training sector is seen as one of the most important and effective factors in meeting this need [1], [6]. Therefore, there is a need to develop critical thinking skills through various ways like the one proposed in this research, The Fun Game Learning Approach.

It is crucial for teachers; especially teacher trainers to know the importance of teaching higher-order thinking skills to prepare the younger generation for 21st century, but how it is taught and assessed are debatable. Critical thinking is defined as a set of skills used by individuals to simply take responsibility and be responsible for thinking [7]. The role of teachers' skills in the development of critical thinking and in teaching environment are equally important [8]. Thus, the change in our teaching method and approach is essential with the transformation and vast changes of our future generation to enhance thinking skill accordingly [9]. Components that make up the essence of critical thinking are expressed as analyzing, interpreting, self-regulation, inference, explanation, and evaluation. Research has shown that a person who has acquired higher level thinking is able to do things such as analyzing the facts, categorizing them, manipulating them, putting them together and applying them in the real life situations [10], [11]. The type of effort and activity an individual chooses and assesses a specific object, problem and condition is defined as creative thinking [12]. According to Lewis & Smith [13, 136]: "Higher order thinking occurs when a person takes new information stored in memory, interrelates and or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situation".

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According to a study conducted by American Colleges and Universities [14], generally, there is a lack of emphasis in the methodology in pre-service teacher training to help enhance higher order thinking skills. One of the main reasons for this as pointed out by [15] is that these teacher-training centers are facing challenges on how to systematically teach it. She further stressed that these skills should be taught more deliberately and intentionally in colleges. This statement was supported by the AACU findings, which states, "To apply knowledge productively in field-based setting, all students should experience in-depth questioning from faculty, staff, and other mentors about their assumptions, analysis, conclusions, and actions" [16, 36-37]. It is hard to convince educators to change research methodology [15]. There are a few teachers who have already challenged the idea to teach and apply higher level thinking skills although there has long been a focus on higher order thinking skills [17]. It has been noted that many assumed that critical thinking would automatically develop as specific disciplines were taught. Studies reported that to enhance higher order thinking skills among teacher trainers are challenging [17], [18].

Research finding showed that teachers are still confused regarding elements of HOTS and how to incorporate these elements in teaching and learning [19], [20]. However challenges faced to inculcate HOTS can be addressed by planning programs either at teachers' level or at the ministry level to promote HOTS courses [21], [4]. Therefore, to improve quality of education in teacher education institution, teachers' continuous professional development and lifelong learning system should be emphasized. As quoted by [22, 1687], "The teacher is the key figure when it comes to influencing student performance and therefore teacher professional development programs should focus on improving teaching quality".

Past studies showed that exploring constructivism learning theory perspective could enhance successful learning outcome [23]-[27]. Meaningful and important concepts within the domain and knowledge can be transferred to other situation with this learning theory. By utilizing this theory, teacher trainers can attract participants engagements and actively involve in critical thinking and hands on activities. Therefore, this study explores the effectiveness of a continuous professional development enhancement program designed to prepare teacher trainers to understand how higher order thinking skills are enhanced through the fun way learning approaches. It is hoped that through this program, these teacher trainers will be able to innovate the education training model in a new and challenging dimension to produce pre-service teachers who are equipped with higher order thinking skills which is the primary focus of the Ministry of Education of Malaysia in its quest to gain the status of a truly world class education system. Here, teacher trainers play an important role in preparing trainee teachers to be critical thinkers. Institutions of higher education learning must evaluate their instructional practices to ensure that both teacher trainers and students are prepared to meet the new challenges in future.

Making learning fun not only motivates individual to

significantly improve the learning performance but it also helps them stay focused on the subject. By manipulating the rules of a particular game, one is able to include elements of higher order thinking skills [28]. The fun approach gives the participants continuous challenges, each of which leads to another challenge, to keep them "hooked". At the same time it helps to enhance one's ability in higher order thinking skills by setting clear and appropriate instructions and tasks within the context the game. Each challenge should satisfy some kind of learning objective, which could be a level in the higher order thinking. The important part of the game is answering questions or identifying challenges posted to players [29].

II. METHOD

Qualitative research method was adopted for this study. Data were collected from observational checklist of participants during the program, four-interview transcription at the end of the program and field notes of the participants after each session. Semi structured in-depth interview questions were developed and used for participants who volunteered and the questions remained open for additional questions that arose. The interview sessions were audio taped and participants were given pseudonyms and identification numbers to protect their identity. Similar research procedures were adopted in past study [30]. The transcribed data later were analyzed with Nvivo analysis process. With Nvivo data analysis, data were uploaded as sources, later were coded for free notes and tree notes. Coded free notes and tree notes were highlighted for text description. Then all the free notes and tree notes were systematically coded for themes and categories. Merged themes were presented in Table I. All the data sources were triangulated, as [31] stated that progressive subjectivity of researchers should report the data analysis within the reflective commentary.

III. RESULT

TABLE I
OBSERVATIONAL CHECKLIST

Observed Behavior	Day 1	Day2	Day3
Engagement in activity	23%	76%	96%
Ability to problem solve	-	61%	76%
Demonstrate critical thinking	-	46%	69%
Post complex questions	-	15%	38%
Ability to create new game	11.5%	38%	92%

Data in Table I present observational checklist by the researcher who observed participants' behavior during the CPD program. On the first day, when the session started in the afternoon, data showed that participants did not participate much on organized fun game activities. Only 23% of the participants participated actively in the activity. Participants also did not show much interest to problem solving or post any complex questions to the facilitators. However on the second and third day data showed that after engagement in hands on activities participants were able to solve problem and demonstrated critical thinking. Participants also created new game during the time given for each group to create a game.

On the last day, each group was given individual tasks to create their own game, rules and demonstrate game strategies. The other teams were asked to post questions for the demonstrating team to solve. The result showed that on day three, participants' engagement in activities showed 96%, where they were able to problem solve 76% and demonstrated critical thinking during hands on activities. 92% percent of the participants were able to create a new game in their own field.

TABLE II
DATA FROM INTERVIEW AND FIELD NOTES

Categories	Free Notes
Hands On activities	".... These activities are hands on as compared to other courses that I've attended before. So by getting involved, we can actually show our students how it's done. Because I'm teaching language, I can apply these techniques and show my students the difference" (Int/A/L17) "The hands-on activities created a platform for participants to questions during session" (F/Day2/L59)
Application	"...I've learned how to improve my method of teaching and making my teaching more fun. The most important thing I've learnt from here is if I'd like to have an impact to the knowledge among the fellow students, I can do it in various ways (Int/D/L7)We are able to incorporate the games that we learned here in our own subject. For example I can see how later I can incorporate these fun games to teach Mathematics" (Int/B/L33) "Participants were able to horn their newly acquired knowledge by coming up with creative activities related to their respective subjects" (F/Day3/L120)
Creating	"I can now ask my students to create and analyze their sentences in a rather different and fun, yet challenging way" (Int/C/L18) "Various situation were created at each station for participant to understand and solve problem" (F/Day2/L91)
Critical thinking	"Participants were able to demonstrate their own creativity and critical thinking during activity"(F/2day/L54) "Some of the participants could use their tactical understanding strategies to solve problem" (F/Day 2/L56)
Use of technology	Students nowadays are getting smarter as technology grow, putting them in such position where they are smarter compared to us because they grow with technology. Because they have gone through that for almost 11 years. So I think using something different yet achieving objective is far better alternative (Int/C/L29)

Table II showed the transcription of the interview conducted with four participants at the end of the program and participants' reflection notes after each session. There were some emerging themes from the interview such as hands-on activity, application, creating, critical thinking and use of technology. One of the participants reported that fun way game learning approach promotes hands-on activities, which gave her the opportunity to get involve and experience the game. "... These activities are hands on as compared to other courses that I've attended before..." (Int/A/L17). In the field notes it is reported, "The hands-on activities created a platform for participants to question during the session" Another obvious emerging theme is application. Two of the participants stated that this game approach would be applied in the subjects that they are teaching which are language (Int/D/L7) and Mathematics (Int/B/L33). "Because I'm teaching language, I can apply these techniques and show my students the difference" (Int/D/L7). "We are able to

incorporate the games that we learned here in our own subject." (Int/B/L33).

The participants proposed to incorporate game in their teaching and thus, make learning the subject become fun. One participant reported that by experiencing this game learning approach she can teach her pupils to 'create' and 'analyze' sentences in a fun way "(Int/C/L18)

The revised Bloom's taxonomy can be looked from two angles; one is knowledge and the other cognitive. Each of these angles represent factual, conceptual, procedural, and metacognitive for knowledge and cognitive and remembering, understanding, applying, analyzing, evaluating, and creating for cognitive [29]. Therefore, it is apparent that this game approach promotes the cognitive dimension, which is 'analyzing' and 'creating'. 'Use of technology' was another theme, which emerged from the interview. The participants felt that as students are well exposed and smarter with technology this game learning approach will be a different approach but able to achieve the objective of the lesson. "So I think using something different yet achieving objective is far better alternative (Int/C/L29).

IV. DISCUSSION

The Fun Way Game Learning Approach emphasizes on discovery and active hands-on learning activities. Therefore it can be very meaningful and authentic to those who participate in these activities. The approach requires participants to cognitively engage in the learning process, determining what is processed, how it is processed, and ultimately what is learned [32]. It is the application of higher-order thinking skill elements, such as; critical thinking, creative thinking, analytical thinking, reflective thinking, problem solving skills, emphasizes on the importance of creative thinking skills and critical thinking skills in particular as part of this learning approach [33].

The importance of learning to solve problem was also stressed and this is in accordance with the revised Bloom's taxonomy which emphasizes on the flow of the cognitive process from simple remembering to higher order critical and creative thinking [34].

Along the lines of the original taxonomy and the revised version, the only difference here is that there is a possibility that each hierarchy may tend to overlap each other in certain instances. In the Fun Way Game Learning Approach, this is prevalent; hence the presence of higher order thinking skills is crucial. During the course, the participant emphasizes that this less rigid approach will help them to apply the knowledge in various ways to their students in enhancing higher order thinking skills [34]-[36]. The research shows that incorporating games in teaching enable the students to think more creatively. Games are the vehicle and environment for learning to take place in a natural setting.

The participants enjoyed the hands-on activities in the Fun Way Game Learning Approach, sharing their experiences of what they did and what they learned from each other. Through collaboration and the stimulation of other participants' ideas, the participants were keen to create their own games.

The hands-on fun games allowed participants to explore games related to specific learning content and help integrate twenty-first century skills such as empathy, cooperation, collaboration plus effective and positive communication. It gave them the freedom to integrate the power of hands-on fun learning into their work through a hands-on exploration of games.

In conclusion the study reported that technology plays a significant role in keeping our younger generation of students engaged and motivated to learn. Moreover, it aids in enhancing their higher order thinking skills. According to [35] the creative and challenging methods are using mobile apps and Web 2.0 tools, using these technologies can cultivate students' higher order thinking skills such as analyzing, evaluating and creating. Thus, a classroom which is enriched with technology gives a positive effect towards the learner's higher order thinking. This is evident from a study conducted to investigate effects of using computers on student development of HOTS [36]. Using this technology enhances students' critical and creative thinking as well as it expands their understanding of core concepts of the lessons they are learning. A similar study was conducted and the finding asserts that use of technology; computer, supports higher order thinking skills among students [37]. Therefore, technology plays a vital role in providing learning environment, which will be a conducive platform for learning to take place. When the students have mastered the HOTS, they will be able to apply the skills in their learning [36]. Hence, the learning will be even more fun and interesting with the use of technology. When care and time is taken to design tasks in an ICT based learning environment, it will surely enhance higher order thinking skills among students [38]. Furthermore, the use of ICT tools such as computer and internet also broadens students' HOTS. The benefits that one can get through this approach are flexibility, authenticity, rationalism, and the ability to look at and solve problems from different perspective [39]-[41]. One of the effective strategies to promote higher order thinking skills is using hands-on activities in the lesson. Engaging students in the lesson as opposed to sitting quietly and listening may provide students the necessary experiential learning [42].

V.CONCLUSION

This study provides some support that well-designed and planned approach which are related to specific learning content that are challenging promotes higher order thinking skills. These are core principles of good teaching and have a powerful relationship. Such bold and innovative approach could "open up options for individuals for whom the traditional educational program has failed" [43], [44]. Furthermore, finding also stated that substantial change in ones attitudes and beliefs is facilitated when he or she changes his or her practice(s) and begins to see the results of these changes in their own students' learning outcomes [45]. In today's fast moving, technology-driven and ever-changing world, the need for creative and critical thinking skills is vital for students. For this purpose, an innovative and creative

approach would be ideal to enhance higher order thinking skills, which are both intuitive and teachable [46].

By being bold and introducing more creativity into the classroom does not make the teacher's job harder. It can actually make it a lot more interesting. Being able to break free from the traditional shackles of teaching means; teachers can use their own creative skills to make the delivery of a lesson more interesting. Teachers who are creative far beyond will find ways to accommodate students' interest [47], [48].

Appropriate, moderate or even bold innovative approaches are seen as essential to provide the most effective learning platform where students learn best [49], [50]. Based on the findings of this study, Enhancement of Higher Order Thinking Skills among Teacher Trainers by Fun Game Learning Approach, it is crucial that all teacher-training institutions include compulsory or elective courses to their existing programs for training teacher candidates in critical thinking skills using this approach. It has been noted that higher order thinking skills like critical thinking have been included when planning curriculum programs and the formation of educational programs [51], [52]. It is undeniable then that critical thinking as an important element of higher order thinking skill, can be enhanced through creative teaching activities, conducive learning environment and the positive role of the teachers [53], [54].

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REFERENCES

- [1] Beşoluk, Ş., & Önder, I. (2010). Review of teacher candidates' approaches to learning, learning styles and critical thinking attitudes. *Elementary Education Online*, 9 (2), 679-693.
- [2] DeVries, R., & Kohlberg, L. (1987). *Programs of Early Education: The Constructivist view*. New York: Longman.
- [3] Mohamad, S.N. (2015). Teachers' Perception on the Integration of Hots in Language Teaching. *International Journal of Technical Research and Applications*. Special Issue 22 PP. 42-44.
- [4] Rajendran, N. S. (2008). *Teaching & Acquiring Higher Order Thinking: Theory and Practice*. Tanjong Malim: Universiti Pendidikan Sultan Idris.
- [5] Ramos, J.L.S., Dolipas, B.B., Villamor, B.B (2013). Higher Order Thinking Skills and Academic Performance in Physics of College Students: A regression Analysis. *International Journal of Innovative Interdisciplinary Research Issue 4*, pp. 48-60.
- [6] Collins, R. (2014). Skills for 21st Century: teaching higher order thinking skill. *Independence Schools Queensland*, Vol 12, Issue 14.
- [7] Elder, L., & Paul, R. (1994). Critical thinking: Why we must transform our teaching. *Journal of Developmental Education*, 18 (1), 34-35.

- [8] Thomas, A. & Thorne, G. (2009). *How to Increase Higher Order Thinking*, Metane, LA. Center for Development and Learning. <http://www.readingrockets.org/article/34655>.
- [9] Serin, O. (2013). The critical thinking skills of teacher candidate. Turkish Republic of Northern Cyprus sampling, *Egitim Arastirmalari-Eurasian Journal of Educational Research*, 53, 231-248.
- [10] Yee, M. H., Jailani, Md. Y., Widad, O., Razali, H. & Tee, T. K. (2011). The Effectiveness of Higher Order Thinking Skills for Generating Idea among Technical Students. *Recent Advances in Educational Technologies*, ISBN: 978-1-61804-322-1.
- [11] Facione, P. (1998). *Critical thinking: What it is and what it counts*. USA: California Academic Press.
- [12] Birgili B. (2015) Creative and Critical Thinking Skills in Problem-based Learning Environments. *Journal of Gifted Education and Creativity*, 2 (2), 71-80.
- [13] Lewis, A. & Smith, D. (1993). Definition of Higher Order Thinking: *Theory to Practice, Teaching for Higher Order Thinking*. Vol 32, No. 3 131-137.
- [14] AACU. (2002). Greater expectations: A new vision for learning as a nation goes to college. *Report of the Association of American Colleges and Universities*, Washington, D.C.
- [15] Minnich, E. (2003). Teaching Thinking: Moral and political consideration, *Change*, 35(5), 18-24.
- [16] Moore, B., & Stanley, T. (2010). Critical thinking and formative assessments: Increasing the rigor in your classroom. Larchmont, NY: Eye on Education.
- [17] Smith V.G. & Szymanski, A. (2013) Critical Thinking: More than Test Scores. National Council of Professors of Educational Administration. *International Journal of Educational Leadership Preparation*, vol 8 (2), 16-25.
- [18] Hummel, J. H. & Huitt, W. (1994). What you measure is what you get. *ASCD Newsletter: The Reporter*, 10-11.
- [19] Onosko, J. J., & Newmann, F. M. (1994). Creating More Thoughtful Learning Environment. In J. Mangieri, & C. C. Blocks (Eds.), *Creating Powerful Thinking in Teachers and Students Diverse Perspectives* (pp. 27-49). Forth Worth: Harcourt Brace College Publishers.
- [20] Resnick, L. B. (1987). *Education and Learning to Think*. Washington DC: National Academy Press.
- [21] Limbach, B., & Waugh, W. (2010). Developing Higher Level Thinking. *Journal of Instructional Pedagogies*, <http://www.aabri.com/manuscripts/09423.pdf>
- [22] Kuijpers, J. M., Houtveen, A.A.M., & Wubbels, T. (2010). An integrated professional development model for effective teaching. *Teaching and Teacher Education*, 26, 1687-1694.
- [23] Balakrishnan, M., Rengasamy, S., Aman, M. (2011). 'Effect of Teaching Games for Understanding Approach on Students- Cognitive Learning Outcome'. *World Academy of Science, Engineering and Technology, International Science Index* 53, 5(5), 808 – 810.
- [24] M Dodds, P., L.L. Griffin & J.H. Placek. (2001). "Selected Review of Literature on Development of Learners Domain-Specific Knowledge" in *Journal of Physical Education*, 20, pp.301- 313.
- [25] Griffin, L.L. & D.A. Sheehy. (2004). "Using the Tactical Games Model to Develop Problem-Solvers in Physical Education" in J. Wright, D. Macdonald & L. Burrows (eds). *Critical Inquiry and Problem Solving in Physical Education*. London, UK: Routledge, pp.33-48.
- [26] Richard, J.F. & N. Wallian. (2005). "Emphasizing Students Engagement in Construction of Game Performance" in L. Griffin & J. Butler (eds). *Teaching Games for Understanding: Theory, Research, and Practice*. Champaign, IL: Human Kinetics, pp.19-32.
- [27] Rovegno, I. & J.P. Dolly. (2006). "Constructivism Perspectives on Learning" in D. Kirk, D. McDonald & May O'Sullivan (eds). *Handbook of Physical Education*. London, UK: Sage, pp.242-261.
- [28] Cardova, D.L. & Lepper, M.R. (1996). Intrinsic motivation and process of learning: Beneficial effects of contextualization, personalization and choice. *Journal of Educational Psychology*, 88, 715-730.
- [29] Amory, A.K. Naicker, J. Vincent, C. Adams (1999). The use of computer games as an educational tool: identification of appropriate game types and elements. *British Journal of Educational Technology* v 30 no4 p311-32.
- [30] Balakrishnan, M., Nadarajah, G.M., Rahim, N.A., Mei, A.W. (2015) Teacher Trainers' Motivation in Transformation of Teaching and Learning: The Fun way Approach. *World of Science, Engineering and Technology, International Science Index, Sports and Exercise Sciences*, 2 (12), 242.
- [31] Guba, E.G. and Lincoln, Y.S. (1989). *Fourth generation evaluation*, Newbury Park: Sage.
- [32] Rink, J. E. (2010). TGfU: Celebrations and cautions. In J. Butler & L. Griffin (Eds.), *Teaching Games for Understanding: Moving globally* (pp. 33-48). Champaign, IL: Human Kinetics.
- [33] Üstünoğlu, E. (2006). The role of questions of cognitive development of high-level thinking skills. *Çağdaş Journal of Education*, 331, 17-24.
- [34] Anderson, L., & Krathwohl, D. (2001). A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives. New York: Addison, Wesley Longman.
- [35] Brooks, S. (2012). '5 Tech-Friendly Lessons to Encourage Higher-Order Thinking'. *The Journal: Transforming Education through technology*.
- [36] Michael, H. Richard, L. Gerald, A. (2001). 'Using a Technology-Enriched Environment to Improve Higher-Order Thinking Skills'. *Journal of Research on Technology in Education, Volume 34, Issue 2, 2001, 109-119*.
- [37] Roschelle, M., Pea, R., Hoadley, C., Means, G. (2000). 'Changing How and What Children Learn in School with Computer-Based Technologies'. *The Future of Children Vol. 10, No. 2, Children and Computer Technology*. pp. 76-101.
- [38] Suhadi, S M., Mohamed, H., Abdullah, Z., Zaid, N M., Aris, B., Sanmugam, M. (2015). 'Enhancing Student's Higher Order Thinking Skills (HOTS) through the Socratic Method Approach with Technology'.
- [39] Gilhooly, K. J., Ball, L. J., & Macchi, L. (2015) Insight and creative thinking processes: Routine and special. *Thinking & Reasoning*, 21(1), 1-4. Doi: 10.1080/13546783.2014.966758.
- [40] Kember, D., & Leung, D.Y.P (2009). Development of questionnaire for assessing students' perceptions of the teaching and learning environment and its use in quality assurance. *Learning Environments Research, Vol 12, Issue 1, pp15-29 (38)*.
- [41] Moore, B., & Stanley, T. (2010). Critical thinking and formative assessments: Increasing the rigor in your classroom. Larchmont, NY: Eye on Education.
- [42] Felder, R.M., & Brent (1999). FAQ-II. *Chemistry Engineering Education*, vol33 (4), 276-277
- [43] Krechevsky, M., & Gardner, H. (1990). Multiple chances, multiple intelligences. In D. E. Inbar (Ed.), *Second chance in education. An interdisciplinary and international perspective*. London: Falmer Press.
- [44] Gardner, H. (1999). *Intelligence reframed. Multiple intelligences for the twenty-first century*. New York: Basic Books.
- [45] Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher*, 15(5), 5-12.
- [46] Newbill, P. & Baum, L. (2012). Design creativity, Learning and Leading with Technology. *ISTE- International Society for Technology in Education*.
- [47] Robinson, K. (2001). *Unlocking creativity: A strategy for development*. Belfast: Department of Culture Arts and Leisure.
- [48] Shaheen, R. (2010) Creativity in Education. *Creative Education*, vol 1, no 3, 166-169.
- [49] Csikszentmihalyi, M., Rathunde, K., & Whalen, S. (1993). *Talented teenagers: The roots of success and failure*. New York: Cambridge University Press.
- [50] Jensen, E. (1998). *Teaching with the brain in mind*. Alexandria, VA: mala2207ASCD.
- [51] Lauder, W., & James, B. (2001) A comparison of critical thinking skills in standard and non-standard entry diploma students. *Nurse Education in Practice*, 1, 212-220.
- [52] Şengül, C., & Üstündağ, T. (2010). Physics teachers' levels of critical thinking attitudes and the place of critical thinking in the organized activities. *Hacettepe University Faculty of Education Journal*, 36,
- [53] Carroll-Johnson, R. M. (2001). Learning to think. *Nursing diagnosis*, 12 (2), 43-44.
- [54] Kökdemir, D. (2003). Uncertainty in decision-making and problem-solving situations). Ankara University, School of Social Sciences PhD Thesis, Ankara.237-248.