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In 1916 Einstein published his extraordinary paper on general relativity which included analysis of the nature of gravity as being affected by the fabric of space-time. I am not a physicist, but have studied Einstein's and related theories for many years. It is very difficult to describe his ideas in a verbal rather than mathematical format; I have tried my best. If you find any apparent errors in my discussion, please let me know. Since Isaac Newton developed his laws of motion, there was little understanding of gravity (i.e., what is it and why it works). Newton did not understand the origin of gravity nor how it affected all objects in the solar system. Einstein solved this problem, using mathematics and systematic astronomical observations by proving that gravity is the change in the smoothness of space-time caused by different objects interacting with each other—e.g., large objects such as planets will produce massive ripples that will cause them to connect unique spatial formations of the solar system. Although he received a Nobel Prize in Physics in 1921, it was not awarded for his work on gravity—originally published by him in 1916 and 1918. After much political wrangling, he received this Prize for his service to Theoretical Physics and his discovery of the photoelectric effect. As a part of his analysis of general relativity, he also predicted the existence of gravitational waves. Many physicists over the last one-hundred years believed they had discovered these waves but the final proof was designed and implemented by researchers using detectors in Livingston, Louisiana and Hanford, Washington. Experts on gravity waves such as Kip Thorne of Caltech and Rainer Weiss of MIT designed an instrument for detecting these waves which was successfully accomplished in 2015. The gravity waves were verified by the interaction of two black holes using this complicated device, the Laser Interferometer Gravitational-Wave Observatory (**LIGO**). Thus, almost one-hundred years after Einstein's Theory of General Relativity, physicists in the United States have demonstrated the occurrence of these waves. (Source: ***Science News Magazine***; March 5, 2016; Author, Marcia Bartusiak, Listening for Gravity Waves).

By studying the history of this research on gravity waves, gifted students can learn a great deal about scientific research. Among these ideas are: Constant review of persistent problems of specific importance to researchers; Interacting with team members and other researchers to search for solutions; Publishing theoretical and research papers on related research; and Designing instruments for detecting the concept under investigation. By studying the biographies of individuals such as Einstein, researchers will be inspired to learn about important factors in their life histories (e.g., see ***Einstein: His Life and Universe*** by Walter Isaacson (2008, Simon & Schuster). Some of these characteristics in Einstein's life were: Extreme interest in and curiosity about how nature works—from a young age of 4 or 5 he was fascinated by magnets; Interested in unusual explanations of the Universe—his formula $E=MC^2$ showed that mass and energy can be changed into one another, leading to the release of massive amounts of energy using a small amount of mass; Non-conformist and independent thinker—used thought experiments to develop his relativity concepts and helped laymen to understand relativity through his famous explanations of the movement of trains; Little respect for old ideas in physics ideas—demonstrated that gravity and acceleration were equivalent to each other; Had little respect for professors' obsolete ideas—he was originally denied receiving a doctorate and university position because of friction with his professors; Concerned with solving difficult political problems—Helped to form the State of Israel; Rigorous student of

mathematics and using new mathematical methods to solve relativity problems—His colleagues around the world used data from a solar eclipse of the Sun near Mercury to accurately predict its orbit; and Constantly discussed his work with friends and colleagues to receive their recommended solutions. For example, he worked with his lifelong friend, Michele Besso, to help solve the problem of Mercury's orbit.

Quotations from Albert Einstein

Quotations from: ***The Expanded Quotable Einstein*** Collected and Edited by Alice Calaprice (Princeton University Press, 1972).

Most teachers waste their time by asking questions that are intended to discover what a pupil does not know, whereas the true art of questioning is to discover what the pupil does know or is capable of knowing.

The aim [of education] must be the training of independently acting and thinking individuals who, however, see in the service to the community their highest life achievement.

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We cannot solve our problems with the same thinking we used when we created them.

Once we accept our limits, we go beyond them.

To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.

The difference between stupidity and genius is that genius has its limits.

The only source of knowledge is experience.

Life is like riding a bicycle. To keep your balance, you must keep moving.

Recommended Readings from the Humanities, Poetry and Science

The Giant Book of Poetry (2010) Kindle Edition by William Roetzheim (Author, Editor).

A Thousand Mornings: Poems (2012) Kindle Edition by Mary Oliver**.**

Bright Wings: An Illustrated Anthology of Poems about Birds (2012, Columbia University Press) by Billy Collins.

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A Passion for Wisdom: A Very Brief History of Philosophy (1997, Oxford University Press) by Robert C. Solomon and Kathleen M. Higgins.

Gifts of the Crow: How Perception, Emotion, and Thought Allow Smart Birds to Behave Like Humans (2012, Simon and Schuster) by John Marzluff , and Tony Angell.

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Einstein's Genius Club: The True Story of a Group of Scientists Who Changed the World (2011, Arcade Publishing) by Burton Feldman (Author), and Katherine Williams (Introduction).

Hidden In Plain Sight 5: Atom (2015) Kindle Edition by Andrew Thomas.

The Hunt for Vulcan: . . . . . And How Albert Einstein Destroyed a Planet, Discovered Relativity, and Deciphered the Universe (2015, Random House) by Thomas Levenson.

Articles

1. **Atara Shriki of the Oranim – Academic College of Education, Israel and Nitsa Movshovitz-Hadar** of **Technion – Israel Institute of Technology, Israel** continue their discussion of research on teaching logical skills to gifted students. This is an outstanding paper (Part 2 is continued from Part 1 published in the Spring 2016 ***GEPQ***) on the problems and issues of teaching gifted students how to think analytically.

2. **Stephen Schroth and Ocie Watson-Thompson** of the Early Childhood Education Department at Towson University discuss how the edTPA (Education Teacher Performance Assessment) program improves the teaching of gifted students.

3. **Catherine Lyles and Echo Wu, Ph.D.** of Murray State University describe how differentiated instruction can be effectively used to teach gifted students in the regular classroom based upon a brief survey of schools in 120 counties in Kentucky. There were a total of 764 valid responses collected from teachers.

4. **Mike Walters of Touro College** talks about how Bill Bryson's books can be used in the gifted classroom.

Maurice D. Fisher, Publisher

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GIFTED AND TALENTED STUDENTS' WANDERING ABOUT "LOGIC IN WONDERLAND"

Part II

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When intuition and logic agree, you are always right. Blaise Pascal

1. INTRODUCTION

This paper is a sequel to the paper that appeared in the previous issue of this journal. It presents insights gained while engaging gifted and talented students (abbr. GTSs) in *Logic in Wonderland*, a learning environment for an introductory course in logic, based upon reading Lewis Carroll's classic book (1865) *Alice's Adventures in Wonderland* (Movshovitz-Hadar & Shriki, 2009; Shriki & Movshovitz-Hadar, 2012_a; 2012_b).

As mentioned in part I (Shriki & Movshovitz-Hadar, 2016) , following a request from the head of one of the GTSs Centers in Israel to teach their students logic, we adapted this environment, which was originally developed for prospective teachers, to 8^{th}-9^{th} grade GTSs.

In part I we discussed the dispute about the benefit of learning formal logic and present briefly the learning environment we generated. Part II, which appears below, is devoted to the study that was intertwined in the learning environment, to the conclusions it suggests, and to deliberations derived from the findings.

2. THE STUDY

The study was exploratory in nature, and focused on the gradual development of the participating GTSs' ability to make valid inferences, namely to draw conclusions logically.

Typically to exploratory studies (Yin, 1993; Babbie, 2007), this approach was chosen because we had no previous information to build on or evidence regarding GTSs' learning processes in the described learning environment. In addition, the participants were a small group of GTSs, who were not randomly selected. In this sense, our research was aimed at gaining initial insights into the way GTSs' knowledge in logic is developed as a result of their involvement in our learning environment.

2.1 Participating students

The gifted and talented department of the Israeli Ministry of Education conducts a yearly national test for identifying GTSs. Gifted students are those who are ranked at the top 1.5% of their age group, and talented students are ranked at the next 5%. This test intends to determine students' learning and intellectual capabilities, rather than predicting the realization of their talent, motivation and creativity. Those who are recognized as gifted or talented are entitled to participate in programs that take place in specialized centers. These centers offer students a choice among various one- or two-semester courses of 90 minute classes a week. *Logic in Wonderland* was a two-semester course offered to GTSs 8^{th}-9^{th} graders that attended the center at Oranim Academic College of Education. Seven 8^{th} graders (2 girls, 5 boys), and two 9^{th} graders (boys) joined the course. Due to confidentiality of information regarding students' achievements in the national test, it was not possible to tell who was identified as gifted and who was identified as talented.

By the time the study started, the participating students had only a limited previous school-based experience related to deductive reasoning, as according to the Israel junior high school mandatory national mathematics curriculum, exposure to deduction is restricted almost only to proving basic theorems in Euclidean geometry about triangle congruency, triangle similarity and the inter-relationship within the quadrilateral family.

2.2 Research focal points

While engaging the participating students in the previous section in learning logic within the environment described above, we were interested in the extent to which these GTSs were initially equipped with some 'logical intuition' that guided their reasoning while dealing with syllogisms-like statements. We were also concerned with the manner in which these GTSs implemented the knowledge they acquired during the learning process. Finally, although this was not at the main focus of the study, we were curious to find out whether these GTSs could reach achievements similar to those achieved by prospective mathematics teachers whom we were teaching a similar course at the same time.

2.3 Data collection and research tools

The research tools employed for collecting the data were designed so as not to create a situation where data collection hindered or interfered with the learning processes. For that purpose, except from the opening and the end-of–course questionnaires, all other data collection instruments were in the form of worksheets. Altogether, four tools were employed, as detailed below.

2.3.1 Opening Questionnaire (See Appendix A)**.** Assuming that GTSs, very much like ordinary students, face difficulties in making valid syllogistic inferences and are not naturally "immune" against making logical invalid inferences, a 10-'syllogisms-like' item questionnaire was administered at the beginning of the first class meeting. Only 'syllogisms-like' items were included in this questionnaire because they were commonly used to examine students' deductive reasoning skills in the 20^{th} century, as mentioned above. Typical to first-order logic, the major premises in these items were sentences of three forms:

- Compound sentences that included negation and conjunction/disjunction (items 1-3);
- Conditional sentences, some including negation (items 4-6); and
- Sentences including quantifiers - Universal, Existential, Only (items 7-10).

In each item, based upon the major and minor premises, the task was to determine whether the conclusion followed logically from the premises, and to choose one of three given options:

(1) Given the two statements it follows necessarily that the conclusion is true;
(2) Given the two statements it is impossible to determine whether the conclusion is true or not;
(3) Given the two statements it follows necessarily that the conclusion is not true.

Finally, the responding students were asked to justify their answers.

It should be noted that because the participants were not yet familiar with the term "valid," the term "true" was used as colloquial for "valid". The correct answer for items 1, 3, 7 and 9 is (1); for items 2, 4, 6, 8 and 10, it is (2); and for item 5, it is (3).

To enable control over the context (Hawkins, Pea, Glick & Scribner, 1984), the contents in five of the items were factual – in two of them (items 6, 8) they were factually true, and in three they were factually false (items 1, 2, 7); In the other five items, the premises' contents were hypothetical – two consisted of meaningless premises (items 3, 9), and in three items the premises were realistic (items 4, 5, 10).

It should be noted that we did not include statements that involve the terms 'necessary condition' or 'sufficient condition', as such terms are not always part of the middle school mathematics curriculum, and therefore their meaning might not be clear to students.

2.3.2 Worksheets. During class-time, the students were assigned worksheets of three types:

(i) Self-diagnostic Worksheet intended to reveal participants' initial related knowledge prior to learning every new topic (an example appears in Appendix B);

(ii) Activity Worksheets designed to get students actively involved in learning the newly introduced topic (an example appears in Appendix C);

(iii) Summary Worksheet for each topic, identical to the Self-diagnostic one, with additional open-ended questions intended to prompt self-reflection upon one's growth of knowledge, and upon unresolved difficulties concerning the learnt topic.

2.3.3 End-of-course Questionnaire (See a sample of two questions in Appendix D)**.** An unseen passage from *Alice* opened this questionnaire. It was followed by 19 questions that covered all the topics learned in the course, including: syllogistic reasoning, examining equivalency of statements, analyzing conditional sentences as sufficient/necessary conditions, and drawing conclusions from two independent unrelated premises.

The aim of this questionnaire was to examine the extent to which participating students had acquired profound knowledge in all the themes included in the course.

2.3.4 Transcriptions of class discussions. Class discussions carried out during the lessons and end-of-course discussion, which focused on participants' gains from their studies, were recorded and transcribed. The ongoing analysis of class discussions enabled us to follow the participants' gradual growth of knowledge, their insights, difficulties and conflicts, and thus served as a formative assessment of the course.

3. RESULTS AND DISCUSSION

In this section, we present and discuss some results obtained from the above mentioned four research tools. In particular, we focus on the following main issues:

(i) GTSs' success in of syllogistic reasoning at the starting point;

(ii) The typical strategy GTSs developed during the course in order to arrive at valid conclusions.

We conclude by a note comparing the typical GTSs' strategy with that of the prospective teachers who studied a similar course in parallel.

3.1 Initial knowledge of syllogistic reasoning: Results from the Opening Questionnaire

It took participants about 30 minutes to complete the Opening Questionnaire (see Appendix A). Seven of the ten syllogisms were completed successfully by all 9 participants. In the other syllogisms (items no. 2, 4 and 10) incorrect reasoning was observed. For these three syllogisms the correct answer was (3), namely, it is impossible to determine whether the conclusion is true or not.

In these three items, students' incorrect reasoning was expressed either by choosing one of the options (1) or (2), or by choosing the right option (3) but providing inadequate explanation.

Relating to item no. 2, five students chose the right option (3), and correctly explained their choice: "*nothing is said about the blue tigers.*" Two students chose option (1), namely, the conclusion is true, pointing in their explanation to the second part of the major premise: "*Here it appears explicitly: 'Blue tigers live in the Arctic.' "*. This argument might indicate that these students assigned the meaning of "and" to "or," as is often the case in the conversational language. The other two students chose option (2), that is, the conclusion is not true, maintaining that "*it is either the first or the second. It can't be both.*" Namely, the students referred erroneously to "or" as an "exclusive or," as is quite common in conversational language, too.

It is noteworthy that no students mentioned that the conclusion was not valid because it did not make sense at all that 'Blue tigers live in the Arctic.' This might indicate that the context was ignored or at least had no effect on students' considerations.

Relating to item no. 4, four students chose the correct option (3), and their explanations indicated that it was chosen for the right reason, e.g.: "*You can pick me up from school even if it doesn't rain.*" The other five students chose option (1). Some explained that: "*Since you pick me up only if it rains, you will not come.*" Clearly, these students related to the first premise as saying "only if…, then…" rather than "if …, then …." Others simply fell into the common trap of denying the antecedent well documented in the literature (e.g., literature review by Stone (2012)). They recalled the second premise stating: "*It is not raining, so why should you pick me up"?* According to Finocchiaro (2005) and others, this widespread error stems from the fact that 'outside' logic, in daily life, denying the antecedent is often accepted as valid. Therefore, it appears that students' daily experience had an effect on their contemplations.

Relating to item no. 10, three of the nine students correctly chose option (3), explaining their answer by saying that "*girls whose name starts with an 'A' may like rainy days as well as sunny ones.*" The other six participants erroneously chose option (1), arguing that "*her name cannot start with an 'A', as all girls with such a name like sunny days, but she likes rainy days.*" Evidently, this syllogism was the most difficult for the GTSs. This supports research findings (e.g., Dubinsky & Yiparaki, 2000), according to which logical inferences concerning predicate logic, in particular where quantifiers are involved, are the most difficult for school age students.

These results might indicate that failure in choosing the right option is more common in syllogisms where the suggested conclusion is neither "true" nor "false" (options 1 and 2, respectively), but rather "impossible to determine" (option 3).This phenomenon was observed only in three out of six item for which the correct answer was option 3, nevertheless, it was also noticed several times during the course. An examination of the consistency and the underlying reasons of this phenomenon were not part of this study.

In addition to the analysis of *the Opening Questionnaire,* students' responses to the Self-diagnostic Worksheets (see section 2.3 above) often included invalid reasoning. Due to space limitation we do not elaborate on them, however all these findings indicate that participating GTSs were not naturally "immune" against making invalid inferences, and that they did not develop fully their reasoning ability during their limited and implicit exposure to logic, through previous learning of school geometry. This supports the observation of Heller, Mönks, Sternberg and Subotnick (2000), Straker (1982), Van Tassel-Baska (1992) and others that GTSs, as much as they differ from ordinary students, cannot be expected to learn everything on their own. In the absence of deliberate instruction, our course participants' competency to draw valid conclusions from given premises was not fully developed by the time our course started.

3.2 The back-and-forth transition between semantic and symbolic representation: An unanticipated strategy and a concern it yielded

Before we go on with the analysis of particular outcomes, let us state that not surprisingly, during the course, participating GTSs acquired quite easily a good command of the rules of inference. This was evident from the discourse that took place in the class meetings that followed their exposure to the rules of inference, truth tables, and Venn diagrams, as well as from their work on various tasks of increasing level of difficulty in the Practice Worksheets, and in the End-of-course Questionnaire.

Nevertheless, while they gradually acquired command of the rules of inference, an unanticipated GTSs' typical strategy for arriving at valid conclusions emerged. We termed this strategy: "The back-and-forth transition between semantic and symbolic

representation". Let us illustrate it in their work on the Practice Worksheet that appears in Appendix C. This worksheet brings a quote of a conversation held by Alice with the Caterpillar, followed by two tasks. In Task A there are three "if…, then…" statements related to Alice and the Caterpillar's conversation, and Task B includes two such statements with quantifiers. The GTSs had to determine whether a suggested conclusion followed from each set of given statements.

Relating to the first task, all the GTSs made no attempt at thinking semantically. They all turned to the syntactic representation almost instinctively, and automatically circled "key sentences," assigned symbols to their parts, and transformed them into the structure depicted in Figure 2:

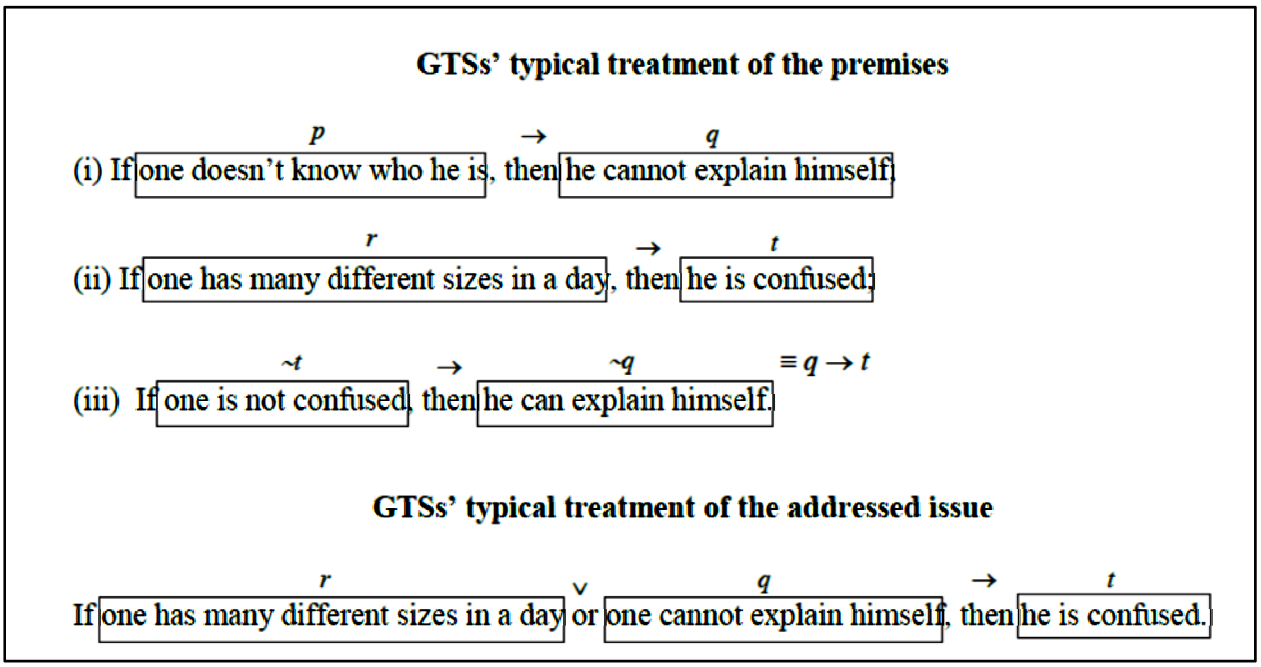

Figure 2- A typical GTSs work by transforming the semantics into symbolic representation towards applying the syntactic rules to Task A appendix C

Having translated the statements into its symbolic representation, the students then constructed a suitable truth table (see Figure 3). Since it was given that $p \to q$, $r \to t$,and $q \to t$ are true statements, they related only to the relevant lines in the table (1, 3, 9, 11, 13, 15, 16), and examined the truth-value of the subsequent $(r \vee q) \to t$. Realizing that for all the 7 relevant cases the truth value of the conclusion was "T," they were able to determine with full confidence that the suggested conclusion followed from the given statements.

Figure 3: A truth table for determining the truth value of the conclusion to Task A, Appendix C. (Lines for the value "T" for all three premises are highlighted, showing that the result is true for all these cases).

	p	q	r	t	$p \to q$	$r \to t$	$q \to t$	$r \vee q$	$(r \vee q) \to t$
1	T	T	T	T	T	T	T	T	T
2	T	T	T	F	T	F	F	T	F
3	T	T	F	T	T	T	T	T	T
4	T	T	F	F	T	T	F	T	F
5	T	F	T	T	F	T	T	T	T
6	T	F	T	F	F	F	T	T	F
7	T	F	F	T	F	T	T	F	T
8	T	F	F	F	F	T	T	F	T
9	F	T	T	T	T	T	T	T	T
10	F	T	T	F	T	F	F	T	F
11	F	T	F	T	T	T	T	T	T
12	F	T	F	F	T	T	F	T	F
13	F	F	T	T	T	T	T	T	T
14	F	F	T	F	T	F	T	T	F
15	F	F	F	T	T	T	T	F	T
16	F	F	F	F	T	T	T	F	T

Yet another illustration is described in Figure 4. It is related to Task B in Appendix C which is a bit more advanced. Here, before GTSs turned to assigning symbols to the "key statements" and to the issue under consideration, some of them found it necessary to rephrase the semantics so that they can employ sets of theoretical language (as marked by arrows in Figure 4). Subsequent to assigning symbols, GTSs were able to represent the relations among these statements using a Venn diagram (see Figure 4), and infer that the conclusion does follow from the first two statements.

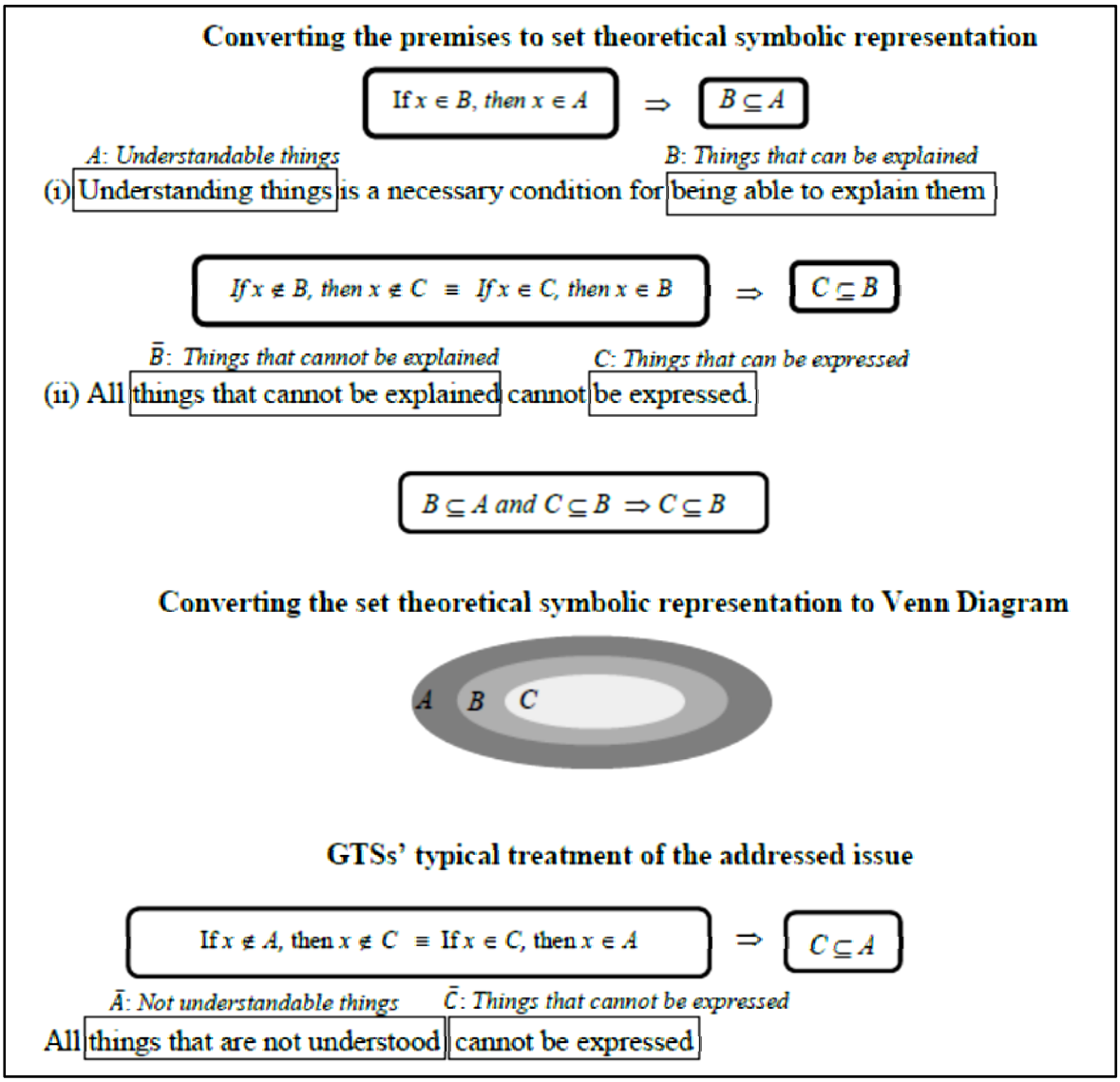

Figure 4: Using equivalency of statements for reaching conclusions

These examples of the manner in which participating GTSs dealt with the assignments, represent in many ways the typical general strategy for dealing with inferences they developed during the last stage of the course. While during the earlier stages of the course, participating GTSs enjoyed responding to such tasks trusting their intuition and then comparing it with answers obtained through implementing the formal rules, toward the end of the course they relinquished such attempts and made no effort at thinking semantically. Rather, in order to examine the validity of suggested conclusions, they immediately turned to the symbolic representation, applying the formal inference rules, or using truth tables and Venn diagrams, in a technical manner. In addition, having completed the syntactic analysis, they seemed totally uninterested in going back to compare their findings with any possible intuitive semantic-based response they may have had.

As we observed this and came to realize it as a repeated behavior, a concern crept in. Might it be the case that during teaching our GTSs the syntactic rules of logic, their intuition was a bit suppressed? To deal with this concern, we suggested to the GTSs that prior to examining the given conclusion by applying the rules they learned, they pay attention to, or better still take note of their intuitive

responses, as they used to at the beginning, so as to become aware of possible gaps between the two. Typically, they rejected this suggestion, stating that "it is *unnecessary,*" "*annoying,*" "*time consuming,*" "*confusing,*" given the easy-to-implement inference rules. Evidently, they preferred to rely on the formal rules, which they learned to trust beyond any doubt: *"I know for sure that this would lead me to the correct solution, so why bother?"* Some of them also used their typical humor to explain why they refused to answer intuitively, and referred to the characters in *Alice: "Without the truth table, I might get confused as Alice was when she met the Cat…"; "It takes more time to answer without the rules, and the Queen will be very angry if we waste time, you know…"; "If I have to deal with so much data I'll go mad like the Hatter, and I am afraid the Queen would order 'off with his head,' so I prefer to play it safe".*

So, is there still a cause for concern? The research literature, points out that a behavior such as we observed is often typical of GTSs. Krutetskii (1976) studied the attributes of mathematically GTSs at school level, and generated a specification of the key elements of mathematical thinking that characterize these students as compared to ordinary ones. Among others, Krutetskii found that GTSs have better ability to formalize and generalize mathematical substances, to isolate patterns from contents, to make abstraction of relationships, and to operate with formal structures. He also found that they have better ability to distinguish important from secondary or irrelevant attributes. Moreover, he claimed that GTSs find it easy to operate with symbols, have the ability to think in logical sequences in order to shorten their reasoning processes, and in general have flexible thinking that enables them to switch from one mental operation to another, to generalize, to formalize, and to constitute logical schemes. This implies that the technical strategy and apparently automatic behavior exhibited by our GTSs are in fact what one might expect from GTSs in situations similar to the ones they were exposed to in our study. It does not necessarily imply any harm to their intuitive mathematical thinking as we suspected. Rather, it can be regarded as evidence to a "*wise and intelligent use of knowledge,*" as gifted students often demonstrate (Sternberg, 2003, p. 8). Namely, their exclusive reliance on a formal-logical approach may suggest that they found formal logic trustworthy and efficient for shortening their reasoning process. This suggests that not only did our study participants not lose their confidence or intuition, just to the contrary – they have developed both the awareness of their intuition as something that may be totally misleading, and also developed a practical defense mechanism against the possibility of falling into its trap.

Moreover, such use of 'technical tools' is very common in mathematics. One can think of the rules of inference as some kind of a formula, similar to many others. For instance, rather than solving each particular case of a quadratic equation from scratch, one solves it usually by applying the solution formula, having previously proved and been convinced that it is trustworthy and efficient for shortening the process of solving *any* case.

Finally, a further approval concerning the uniqueness of the GTSs' approach to validity examination of conclusions from the syllogism-like tasks was provided by comparing the GTSs' responses to the Practice Worksheets with prospective teachers' ones to the same Practice Worksheets in the framework of a similar course we taught in parallel to this course for GTSs. As indicated by the prospective teachers' responses (Shriki & Movshovitz-Hadar, 2007) they were often inclined to analyze syllogisms in a rather intuitive manner, and frequently attempted to relate them to their own everyday life experiences. In fact, many of their errors resulted from their tendency to adhere to an intuitive approach, failing to view it as possibly deceptive, and unable to comprehend the power of applying the formal rules. Furthermore, the GTSs' achievements in the End-of-course Questionnaire (see appendix D) were similar to those of the top 10% of prospective teachers who responded to this same questionnaire as their final examination in a similar course based upon *Logic in Wonderland* (Shriki & Movshovitz-Hadar, ibid). These results are in line with those of Suppes & Binford (1965) who found that young gifted children did almost as well as college students in a formal logic course.

Therefore, it appears that, unlike the prospective teachers' approach, the 'technical' approach found as typical to our GTSs kept them secure and confident about going 'the right way', hanging to the formal rules and metaphorically speaking, using them as "crutches" to support their keeping in balance while "walking" on logical grounds.

4. CONCLUDING REMARKS

We would like to conclude this paper by pointing out two issues worthy of further studies: (i) Transfer of the ability acquired, and (ii) the cognitive vs. affective impact of the story of *Alice* as an environment for learning logic.

4.1 Transfer of the ability acquired

As indicated above, the ability to transform a verbal statement (the semantics) into the corresponding symbolic representation (the syntax) and applying the rules of inference to it, became an almost 'second nature' to the GTSs, soon after they had been introduced to it. Interestingly, this second nature left its mark also outside the logic class, as some GTSs reported that "*Often, while reading a story book or a daily newspaper, I turn to the symbolic representation of some statements in order to quickly examine the validity of the inferences that appear there*"; or "*Recently I have started to examine the logic in our history textbook. You want to know why? Because I don't like history, and I'll be glad to be able to find some inconsistencies there, in order to show my history teacher that the book is wrong…."* This brings up the general issue of transfer from the logic class to other areas. In particular, the dispute about the effect of studying formal logic on improving the learning of mathematics (Epp, 2003) comes to mind. Recall that in initiating this exploratory study we refrained from taking sides in this dispute. Nevertheless, a follow up study is due, aiming at the examination of such transfer and its manifestation in the development of deductive reasoning ability as well as in the development of mathematical problem solving ability of a group of GTSs who would go through an experience similar to that which our GTSs went through, as compared to groups of GTSs who would not.

4.2 The impact of employing *Alice in Wonderland* as a context for learning formal logic

In the last session of the course, the GTSs were asked to relate to the impact of embedding the study of logic in the reading of *Alice in Wonderland*. Did reading of *Alice* have a positive effect on the learning of logic, or maybe it impeded the GTSs' understanding? In their responses our GTSs did not express a relation between their gains of knowledge in logic to the embodiment of the study in the story of *Alice*. However, their utterances suggest that the story had an affective impact, adding enjoyment to the learning of the contents. Here are some representative quotes: "*It helped me to see logic as something concrete and relevant to my world. If logic is in fairy tales, then logic is everywhere*"; "*It reminded me of my childhood, and thus turned logic, which I thought was a 'heavy issue,' into something 'light' and fun*"; "*The plot of the story is quite absurd, therefore it was fun to read it and imagine the strange happenings, and then connect it to 'real life' logic.*" Only one of the nine GTSs maintained that "*Reading Alice was not the main thing. I could study logic merely by learning about connectives and quantifiers, and I didn't need Alice, but it did not harm to recall the story, it was even fun.*" Further support to this claim can be found in students' humorous explanations to declining the request for content-dependent considerations, quoted in section 3.2. Such affective factors are recognized as significant for nurturing gifted students' motivation to learn (e.g. Porath, 1996). In general, providing students with a learning environment that is both enjoyable and engaging is essential for students' deep involvement in learning, and in fact learning is most effective when students enjoy what they are doing (Renzulli, 1994). Furthermore, since GTSs often have an intense imagination and sense of humor, and the ability to understand ironic situations (Frasier & Passow, 1994), it appears that from the *affective* point of view *Alice* is particularly suitable as an environment for teaching them logic. Nonetheless, further research is needed in order to deepen the understanding of the *cognitive* aspect of embedding the study of various topics in logic in the context of *Alice*.

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Appendix A: Opening Questionnaire

In each of the following cases appear two true statements followed by a suggested conclusion.
For each case you have to choose one of the options:

(1) Given the two statements it follows necessarily that the conclusion is true;
(2) Given the two statements it follows necessarily that the conclusion is not true.
(3) Given the two statements it is impossible to determine whether the conclusion is true or not;

Write your justification for your chosen answer.

		The statements	Suggested conclusion	My choice[1]			My justification
				(1)	(2)	(3)	
1	a	Dinosaurs did not extinct and there is life on Mars	Dinosaurs did not extinct	+			
	b	There is life on Mars					
2	a	Polar bears live in the jungle or blue tigers live in the Arctic	Blue tigers live in the Arctic			+	
	b	Polar bears live in the jungle					
3	a	Big triangles are yellow or small rectangles are green	Big triangles are yellow	+			
	b	Small rectangles are not green					
4	a	If it rains today, then I will pick you up from school	I will not pick you up from school			+	
	b	It is not raining today					

5	a	If Snoopy the dog barks then Snoopy the dog does not bite	Snoopy the dog barks		+		
	b	Snoopy the dog bites					
6	a	If today is Independent Day then today there is fireworks	Today is Independent Day			+	
	b	Today there is fireworks					
7	a	All frogs can run	Kermit cannot run		+		
	b	Kermit is a frog					
8	a	There exists people who can walk	Gil can walk			+	
	b	Gil is a person					
9	a	Only fish are happy	Mickey is not happy			+	
	b	Mickey is a mouse					
10	a	All the girls whose name starts with an 'A', like sunny days	My girlfriend's name does not start with an 'A'			+	
	b	My girlfriend likes rainy days					

[1] The right choices indicated by + in the body of the table were not provided, of course, to the students**.**

Appendix B: The Self-diagnostic Worksheet before studying implication and conditional sentences

In each of the following cases appear two true statements followed by a conclusion.

For each case you have to select one of the options:

(1) Given the two statements it follows that the conclusion is true;

(2) Given the two statements it follows that the conclusion is not necessarily true;

(3) Given the two statements it follows that the conclusion is false.

Justify your answers.

		The statements	**The conclusion**	**(1)**	**(2)**	**(3)**
1	a	If the White Rabbit comes to the Tea-Party, then Allice is happy	Alice is happy			
	b	The White Rabbit does not come to the Tea-Party				
2	a	If the White Rabbit comes to the Tea-Party, then Allice is happy	The White Rabbit comes to the Tea-Party			
	b	Alice is not happy				
3	a	If the White Rabbit comes to the Tea-Party, then Allice is happy	Alice is happy			
	b	The White Rabbit comes to the Tea-Party				
4	a	If the White Rabbit comes to the Tea-Party, then Allice is happy	The White Rabbit comes to the Tea-Party			
	b	Alice is happy				

Appendix C: An example of a Practice Worksheet

Wandering in the wood, thinking of how to grow back to her original size, Alice did not see anything that looked like the right thing to eat or drink except for a mushroom, about the same height as her. She stretched herself up on tiptoe, and her eyes met those of a large caterpillar that "*was sitting on the top with its arms folded, quietly smoking a long hookah, and taking not the smallest notice of her or of anything else.*"

Alice meets the Caterpillar (Chapter V)

The Caterpillar and Alice looked at each other for some time in silence: at last the Caterpillar took the hookah out of its mouth, and addressed her in a languid, sleepy voice.
'Who are YOU?' said the Caterpillar.
This was not an encouraging opening for a conversation. Alice replied, rather shyly, 'I—I hardly know, sir, just at present—at least I know who I WAS when I got up this morning, but I think I must have been changed several times since then.'
'What do you mean by that?' said the Caterpillar sternly. 'Explain yourself!'
'I can't explain MYSELF, I'm afraid, sir' said Alice, 'because I'm not myself, you see.'
'I don't see,' said the Caterpillar.
'I'm afraid I can't put it more clearly,' Alice replied very politely, 'for I can't understand it myself to begin with; and being so many different sizes in a day is very confusing.'
'It isn't,' said the Caterpillar.
'Well, perhaps you haven't found it so yet,' said Alice; 'but when you have to turn into a chrysalis—you will some day, you know—and then after that into a butterfly, I should think you'll feel it a little queer, won't you?'
'Not a bit,' said the Caterpillar.

Task A: In Wonderland the following three statements are true:

(i) If one doesn't know who he is, then he cannot explain himself;
(ii) If one has many different sizes in a day, then he is confused;
(iii) If one is not confused, then he can explain himself.

Determine whether the conclusion bellow follows from these statements:

If one has many different sizes in a day or one cannot explain himself, then he is confused.

Task B: In Wonderland the following two statements are true:

(i) Understanding things is a necessary condition for being able to explain them;
(ii) All things that cannot be explained cannot be expressed.

Determine whether the conclusion bellow follows from these statements:

All things that are not understood cannot be expressed.

Appendix D: two problems from the End-of-Course Questionnaire

Problem no. 1

In one of the days, the Queen of Hearts baked tarts and someone stole them. The Queen of Hearts suspected the Knave of Hearts, and decided to put him on trial. The hotheaded King was the judge, and there were twelve jurors.
The first witness was the Hatter.
'Take off your hat,' the King said to the Hatter.
'It isn't mine,' said the Hatter.
'Stolen!' the King exclaimed, turning to the jury, who instantly made a memorandum of the fact.
'I keep them to sell,' the Hatter added as an explanation; 'I've none of my own. I'm a hatter.'

In Wonderland the following statement is true:
(i) The hat on the Hatter's head does not belong to him, and the Hatter does not have any hats of his own.

In Wonderland the following statement is false:
(ii) The King thinks that the hat on the Hatter's head is not stolen.

Which of the statements is/are true in Wonderland? Justify your answer
a. The King thinks that the hat on the Hatter's head is stolen, or the Hatter has hats of his own;
b. The hat on the Hatter's head belongs to him, and the King thinks that the hat on the Hatter's head is stolen;
c. The Hatter has hats of his own, or the hat on the Hatter's head belongs to him.

Problem no. 3
After Alice gave her testimony, the King was determined to get the verdict. The White Rabbit told the King that new evidence had just arrived. This was a note with "a set of verses."

'Are they in the prisoner's handwriting?' asked another of the jurymen.
'No, they're not,' said the White Rabbit, 'and that's the queerest thing about it.' (The jury all looked puzzled.)
'He must have imitated somebody else's hand,' said the King. (The jury all brightened up again.)
'Please your Majesty,' said the Knave, 'I didn't write it, and they can't prove I did: there's no name signed at the end.' 'If you didn't sign it,' said the King, 'that only makes the matter worse.'
You MUST have meant some mischief, or else you'd have signed your name like an honest man.'
There was a general clapping of hands at this: it was the first really clever thing the King had said that day.
'That PROVES his guilt,' said the Queen.
'It proves nothing of the sort!' said Alice. 'Why, you don't even know what they're about!'

Here are four statements:

a. If the note belongs to the Knave, than the note belongs to a prisoner;
b. Every signed note only makes the matter worse;
c. In every note that does not belong to the Knave there is no imitation of somebody else's hand;
d. Only a note that belongs to someone who is not a prisoner is signed at the end.

Considering all four statements, what logical conclusion can be drawn?

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Building a Better Teacher: How the edTPA Enhances Classroom Learning Opportunities for Gifted Children

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An excellent teacher in every classroom has long been a goal of American public education (Danielson, 2007). As part of recent reform efforts designed to improve the quality of teachers in public school classrooms in the United States, the edTPA has been created in an attempt to better assure that graduates of teacher education programs are "classroom ready" upon assuming their duties (Darling-Hammond & Bransford, 2005; SCALE, 2015). While focused on a new teacher's ability to plan and deliver instruction and to assess student learning, the edTPA holds great promise for improving the instruction of gifted children (SCALE, 2015). As a culminating task, most programs that prepare practitioners for the classroom have traditionally required the teacher candidates to prepare a portfolio or complete some other assignment that demonstrates their ability to perform in the classroom (Danielson, 2007; Marzano & Toth, 2013). These culminating tasks, however, have encouraged teacher candidates to focus on their class's performance as a whole, permitting the success or struggles of individual children or groups to be glossed over or ignored (Darling-Hammond, 2013a). Instruction directed toward gifted children, and assessment of their learning outcomes, often are overlooked as a result of this emphasis.

Many reform efforts of the past 30 years have focused chiefly upon helping struggling learners build their skills or decreasing the achievement gap between certain groups of children (Darling-Hammond, 2013b). These are certainly admirable goals and of great importance. They do little, however, for gifted children, especially those from traditionally underserved populations (Hollins, 2015; Tomlinson, 1999). The edTPA, by contrast, asks teacher candidates to record, analyze, and reflect upon the learning outcomes of *all* children (SCALE, 2015). This includes the general education population, children of color, English language learners (ELLs), students from low-SES backgrounds, students with special needs, and gifted children (SCALE, 2015). As a result of this, teacher candidates must examine and reflect upon the learning outcomes of gifted children. This change in practice may bear multiple benefits for gifted children, as new teachers will have become acculturated to assessing all of their students' learning needs and devising ways to teach them new material and to assess their growth.

This article examines what the edTPA is, how it is used, who it affects, and who uses it. Next, it explores the focus on the planning, delivery, and assessment of instruction, as well as how the quest to improve student outcomes affects *all* learners. Finally, the article will examine how children's progress in the classroom is monitored, what aspects of student performance teacher candidates must address, and the benefits of this approach for gifted children. Certainly, these advantages are possible only if the edTPA is implemented with fidelity. Nonetheless, the edTPA holds great promise that new teachers will be better prepared to work with diverse learners, including gifted children.

edTPA

Ensuring that teacher education programs produce new teachers who are "classroom ready" has long been an interest of many (Darling-Hammond & Bransford, 2005). In order to assure this, the edTPA was created to determine whether teacher candidates are ready for their own classrooms (Hollins, 2015; SCALE, 2015). The edTPA is a culminating task that assesses teacher candidates' ability to plan and deliver instruction and assess student learning (SCALE, 2015). The edTPA is a subject-specific assessment that has versions in 27 different teaching fields (Hollins, 2015; SCALE, 2015). Of particular interest to parents of gifted children are the edTPAs that assess future early childhood, elementary, middle childhood and secondary education teachers. All versions of the edTPA evaluate a new teacher's skills at planning, instruction, assessment, analyzing teaching, and vocabulary development (SCALE, 2015). In particular, the edTPA asks teacher candidates to collect, reflect upon, and use information about each student's background, learning preferences, talents and needs, and other factors (SCALE, 2015). These factors include those students who are gifted or achieving at a very high level (SCALE, 2015).

With the number of teachers with three or fewer years of experience topping 15% nationally, many have expressed a desire to ensure that new teachers possess the confidence and skills necessary to succeed in a variety of settings. To date, twelve states—California, Delaware, Georgia, Hawaii, Illinois, Iowa, Minnesota, New York, Oregon, Tennessee, Washington, and Wisconsin—have adopted the edTPA as a preparation requirement for new teachers, as a requirement for initial certification or licensure, or as part of the accreditation process for institutions engaged in teacher preparation (AACTE, 2015). Other states, as well as the District of Columbia, are considering requiring the use of the edTPA (AACTE, 2015). In all, teacher preparation programs in 39 states are using the edTPA to assess new teachers to determine that they have entry-level teaching skills and demonstrate readiness for the classroom (AACTE, 2015). If a teacher candidate completes the edTPA, and receives a score showing proficiency or better, he or she will be issued a teaching certificate or license providing that other program and state requirements are fulfilled (Darling-Hammond, 2013b; Hollins, 2015; Levine, 2006). Some programs or states will permit candidates whose scores narrowly miss passing to redo those sections that were inadequate (Darling-Hammond, 2013a; Hollins, 2015). Other candidates will have to redo the edTPA, and possibly student teach again, if they wish to receive certification or licensure (Darling-Hammond, 2013a; Darling-Hammond, 2013b; SCALE, 2015).

Certainly the edTPA is not without its critics (see, e.g., Dover, Schultz, Smith, & Duggan, 2015). Some teacher educators object to those from outside their program, department, or college evaluating their teacher candidates (Dover et al., 2015). When one examines the edTPA, however, one finds that it concentrates on teacher candidates' ability to plan instruction, deliver instruction, and assess student learning as a result of that instruction (Atkins, Spesia, & Snakenborg, 2015; SCALE, 2015). These skills seem central to any teacher's practice, and it seems odd that anyone could object to this focus. Additionally, the critics of the edTPA seem to ignore that most other "learned" professions—such as law, medicine, nursing, and the like—rely on outside evaluators to determine whether recent graduates may join their state's professional association and obtain initial licensure. As many in teacher education advocate for increased professionalization of teaching, it seems that outside evaluation is one of the elements of that process (Atkins et al., 2015).

Planning and Delivering Instruction and Assessing Student Learning

The edTPA's focus on teacher candidates' proficiency at planning, delivering, and assessing instruction is intended to assure that *all* children have access to a quality education (Darling-Hammond, 2013b; SCALE, 2015). This explicit charge is to focus on both the class as a whole as well as individual subgroups within that class (Darling-Hammond & Lieberman, 2013; Hollins, 2015). This includes ELLs, special needs students, those from low-SES backgrounds, gifted learners, and children of color (SCALE, 2015).

The edTPA has caused more schools, colleges, and universities to embrace Universal Design for Learning (UDL) principles, which encourage teachers to consider the best ways to provide equitable opportunities to reach high standards across variable students (Meyer, Rose, & Gordon, 2014). UDL endorses teachers providing:

- Multiple means of engagement;
- Multiple means of representation; and
- Multiple means of action and expression (Meyer, Rose, & Gordon, 2014).

Within these three principles, UDL has developed nine guidelines that assist educators in achieving more optimal learning experiences (Meyer, Rose, & Gordon, 2014). While providing multiple means of engagement, teachers should work to offer options for self-regulation, for sustaining effort and persistence, and for recruiting interest (Meyer, Rose, & Gordon, 2014). When providing multiple means of representation, teachers should afford options for comprehension; for language, mathematical, expressions, and symbols; and for perception (Meyer, Rose, & Gordon, 2014). Finally, when providing multiple means of action and expression, teachers must make available options for executive functions, for expression and communication, and for physical action (Meyer, Rose, & Gordon, 2014).

Children learn best when instructional activities present them with a moderate level of challenge (Tomlinson, 1999; 2001). When tasks are far too difficult for a learner, he or she feels threatened and often will, as a self-protection mechanism, not persist with

creative thinking or problem solving (Tomlinson, 1999). Conversely, tasks that are too simple also suppress a learner's creative thinking and problem solving abilities. In these cases, unchallenged learners drift through school and other activities, indifferent to the learning process and having been covertly told that learning is not important (Tomlinson, 1999; 2003). Either situation is dire, especially for those students for whom school represents the sole connection with the learning process (Tomlinson, 2001; 2003). Parents and teachers who are interested in decreasing the time gifted children spend with inappropriate tasks seek to differentiate activities so that the needs of all learners are met (Smutny & von Fremd, 2010; Tomlinson, 2003). Differentiation involves adjusting the complexity of content, the processes used for instruction, and the products students produce in order to afford each child an appropriate challenge (Tomlinson, 2001, 2003).

Differentiation presents such a compelling model for classroom modification of instruction but it is predicated upon a teacher having deep and meaningful insights into a particular child's strengths and needs (Schroth et al., 2011; Tomlinson, 2001; Smutny & von Fremd, 2010). Differentiation provides a configuration that novice teachers can use to set up their practice. Differentiation asks teachers to determine the readiness and needs of each gifted child, and then to provide that child with instruction and activities that are appropriate, cogent, and beneficial. Because the edTPA demands that competent teachers demonstrate that they can differentiate, it increases the chances that gifted learners will receive appropriate instruction, assignments, and feedback.

Classroom teachers are, of course, the experts regarding the children in their care. Teachers who examine any set curriculum or set of standards understand that parts may need modification to best meet individual or group needs. When forced to use "one-size-fits-all" instructional materials, many teachers find that gifted children in their classrooms are not challenged, lose motivation, and are off task. Even when the teacher differentiates instruction to provide an appropriate level of challenge, some gifted children will do what it takes to get by, seemingly uninterested in producing their best work. With its emphasis upon individualized feedback, the edTPA increases the likelihood that each learner in a classroom will be better able to improve over time (SCALE, 2015; Schunk & Swartz, 1991). Gifted children respond better academically if provided with adequate and appropriate feedback with regard to their work, something that often does not happen in the general education classroom (Bland, Sowa, & Callahan, 1994; Schroth & Helfer, 2015). The failure to receive adequate feedback is especially damaging to gifted children from traditionally underrepresented groups, as they often rely more heavily upon their schools for increased challenge and opportunities than do others (Callahan, 2005). That the edTPA demands individualized feedback that concentrates on each child's strengths and needs makes us hopeful that gifted children will receive better responses to and critiques of their work from the teacher than "Great job!" or "Excellent!"

Potential Benefits for All Children

The edTPA promises to help new teachers to better plan and deliver instruction and assess student learning for all children, including the gifted. Too often, gifted and talented children are ignored as teachers—understandably—focus on struggling learners and closing the achievement gap (Schroth & Helfer, 2015; Tomlinson, 2003). The edTPA suggests better treatment for all students, especially the gifted, insofar that it uses several practices traditionally used with high-ability learners. First, the edTPA asks that teacher candidates assess student knowledge, understandings, and skills before and after instruction, a step that can eliminate needless review for children who already have mastered a topic (Colangelo, Assouline, & Groos, 2004; Moon, Tomlinson, & Callahan, 1995). Once children's learning needs are determined, the edTPA demands that teachers plan for these needs, differentiating instruction where necessary to do so (SCALE, 2015). Such differentiation is especially needed for gifted children, who are often unchallenged and bored in the classroom (Feldhusen, 1989; Tomlinson, 1999; Ward, 1961).

The edTPA also encourages teacher candidates to reflect upon how changes in their instructional practices might improve student performance (SCALE, 2015). Again, this essential act of good teaching assists all students, including gifted children, as it permits teachers to contemplate the achievements and challenges—real and possible—facing individual children (Schroth et al., 2011). For a student to develop his or her skills fully and to address specific learning needs, teachers must be able to imagine the futures that are possible for that child (Greene, 2000). The edTPA asks teacher candidates to reflect upon each instructional sequence delivered and ask several questions. These questions compel the teacher candidate to ask: Was this instructional sequence too difficult for this student? Were the instructional activities too easy for this student? How might this student's performance be improved by altering the lessons, activities, and assignments? Through compelling the contemplation of such questions, and demanding responses to them, the edTPA brings best practices to the classrooms of new teachers, which benefits gifted learners.

Other Benefits

In addition to improving the practices of those new to the classroom, the edTPA also serves to bring together different stakeholders who affect teacher preparation. These stakeholders include mentor teachers, administrators, specialists, parents, students, professional development school (PDS) liaisons, and university faculty. For those colleges, schools, and departments of education that have PDS partnerships, orientation meetings and training sessions are a means of familiarizing mentor teachers and administrators with the edTPA (SCALE, 2015). More important for gifted children and their parents, however, are the ancillary benefits that this training will have (Darling-Hammond, 2013a; Tomlinson, 2003). As best practices in teaching and assessing all children are reviewed, practicing teachers are reminded of the importance of charting the learning of all students (Smutny & von Fremd, 2010; Tomlinson, 2001).

Teacher education programs adopting the edTPA need to familiarize their faculty with and train them in using the edTPA. While excellent teacher education programs will find nothing unfamiliar in the edTPA, the nomenclature and structure of the performance assessment take some time to fully understand and appreciate. After this group is proficient in preparing teacher candidates to use the edTPA, it can begin to be used with the future teachers. Many programs elect to use local scoring for the first few years of implementation. Local scoring has the advantage of helping all stakeholders become familiar with the edTPA process and confident in the efficacy of the process. After this occurs, many programs elect to go with national scoring, which has the advantages of correlation with national norms and less of a burden upon program faculty. Either choice, however, benefits children in classrooms who are provided access to teachers who have demonstrated their proficiency via a cutting edge teacher performance assessment.

Conclusion

The edTPA demands that new teachers are ready to run their own classrooms at a proficient level from their first day on the job (SCALE, 2015). Presenting teacher candidates with such a rigorous yet authentic evaluation will make them better able to assume their responsibilities in the classroom and to provide children with the level of services that they need (Daniels, 2007; Darling-Hammond, 2013b; Hollins, 2015). This new assessment instrument promises to improve teacher quality and the ability of classroom practitioners to provide all children with the most appropriate instruction. This is tremendous news for all students, including children of color, ELLs, and gifted children, all of whom are traditionally underserved by American public education (Bruner, 1960; Ford, 2013; Renzulli, 1986). The edTPA's attention to individual student's needs and learning will increase the attention that teachers pay to gifted learners and improve the level of challenge each is provided.

Teachers deemed "classroom ready" have long been charged with teaching all students, including the gifted (Schroth et al., 2011; Wiltz, Daniels, Skelley, Cawley, & Watson-Thompson, 2013). Advocates for gifted children will better advance their cause if they learn and use the vocabulary now being employed in teacher education programs when promoting better educational opportunities for advanced learners. Understanding that new teachers, mentor teachers, and administrators are familiar with terms such as *supports*, *multi modal learning*, *vocabulary development*, *academic language*, *evidence of learning*, *pretest*, *posttest*, *differentiation*, and *gifted* will help to guide conversations regarding an individual gifted child's progress or lack thereof. No more will it be acceptable to merely show that a gifted learner has demonstrated proficiency in an area of learning. Instead, parents and other advocates may ask for evidence that the gifted child is demonstrating growth in relation to his or her pretest performance.

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Teachers' Responses on Differentiating Instruction and Measuring Progress of Gifted Students in the Regular Classroom

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Abstract

Providing differentiated instruction in the regular classroom has become more and more common as a key component for school teachers in regular classroom teaching. However, how much and how often teachers differentiate instruction in their regular classrooms, and how they measure gifted students' progress are still questions to be investigated. Specifically, it is even more interesting to know how teachers differentiate their teaching catering to artistically gifted students. This study uses a survey to explore these questions regarding differentiation with 4-12 grade teachers in a state in the mid-south of the United States. A simple online survey with 9 questions, focusing mainly on teachers' practices related to differentiated instruction in the classroom, including visual and performing arts classrooms, was sent out to elementary and secondary school teachers in over a hundred counties in the state through Survey Monkey. There are a total of 764 valid responses collected from teachers. The results and implication of the study are discussed.

Introduction

Differentiating instruction (DI) is not a new concept at schools in the United States, but whether or not teachers are practicing DI within regular classrooms remains a question to be answered. There is no doubt that DI is not just differentiating teaching for gifted students, but also for all students. The primary goal for DI is to cater to students' individual needs, and consequently, the decisions on how the curriculum needs to be modified for differentiation should be based totally on each individual student's needs (Tomlinson, 2005). Furthermore, using DI provides educators with a variety of ways of teaching, helping not only the majority, average students, but also the gifted as well as special needs students to achieve at their own levels, and to be academically successful.

Research has shown that teachers perceive DI to be very helpful and relevant in order to meet student needs (Bailey & Williams-Black, 2008; Stone, 2012). Students are more active and their academic as well as social skills are improved, and the lessons are more effective (Altintas & Ozdemir, 2015). Through DI, students will have a chance to take a greater responsibility and ownership for their own learning. DI is an effective tool to implement in the classroom in order to meet students' learning styles and multiple intelligences strengths which, in turn, encourage them to use higher-order thinking (Bailey & Williams-Black, 2008). Teachers in regular classrooms can use well-practiced strategies or develop their own strategies for differentiating instruction so that every student can be supported in progressing from their present level of performance to a much higher level that matches their potential (Ensign, 2012).

The main purpose of this study is to explore whether and how teachers differentiate within the regular classroom, and how they measure gifted students' progress. Besides exploring whether and how teachers differentiate, this study also asks questions on topics such as whether the teachers think they need professional development on DI, and how teachers measure gifted students' progress. The question of measuring students' progress is important as when teachers differentiate instruction, they need to know whether gifted students are actually making progress.

A self-designed survey, which contains nine questions (see Appendix A), was used to ask teachers whether they differentiate their regular classroom teaching, and if yes, what strategies they use, whether they believe they need further professional development, as well as how they measure gifted students' progress. Through this survey, the researchers aim to gain a better understanding of whether and how teachers adopt and practice DI within the regular classroom.

Differentiation in the Regular Classroom

Rapid changes of the global educational environment as well as the recognition of diversity of students, teachers, no matter in which subject area, are all expected to meet the diverse needs of students in the regular classroom with higher degrees of accountability (VanTassel-Baska & Stambaugh, 2005). It is common sense that not all students learn the same way, given that they have diverse abilities and interests, and come from diverse backgrounds. In a regular, heterogeneous classroom in the United States, teachers may find their students are all different, having a variety of levels of abilities, interests, learning styles, and life experiences. Consequently, they may learn differently being taught by the same teacher within the same classroom, using the same teaching methods.

Differentiation, a process wherein teachers modify instruction based on their students' specific needs, is necessary in order to maximize each individual student's learning (Latz, Speirs Neumeister, Adams, & Pierce, 2008). DI, as Dr. Carol Tomlinson envisioned, "does not seek to label and segregate students, but rather to serve them effectively in heterogeneous classrooms that are responsive to their varied needs" (Wu, 2013, p.127). Differentiation is more a way of teaching, which begins with an idea that every student in the class is extremely important, and each of them does not have any choice but to trust teachers, and if the work teachers ask them to do is way too hard or too easy, the gifted students simply cannot learn properly (Wu, 2013). Differentiating instruction means changing the pace, level, or depth of learning in response to the gifted student's needs, learning styles, and interests (Sisk, 2009).

It would be a perfect world if all teachers can differentiate. However, in reality, it is far more complicated and teachers are normally too often concerned about the standardized test scores, and barely pay much attention, if any, to cater to the different needs of their students and adjust their teaching pace, level or depth. If not given the opportunities to be challenged in their areas of giftedness, gifted students may regress, lose their drive and experience behavior problems in school and at home. Their potential of giftedness may become stagnant to non-existent, and their giftedness and talent will not grow into high abilities in the actual world.

In today's inclusive classrooms, no matter whether it is an elementary, secondary or tertiary level, DI plays a critical role in meeting the diverse needs of individual students. Choosing suitable DI strategies and implanting in proper ways, DI allows all students in the same class to access the same curriculum by providing different learning materials, learning activities and assessments that are tailored to students' styles, interests, and their learning needs. When instructions are differentiated, students can learn better and achieve higher, and in addition, their motivation to learn is much higher than those in a traditional learning environment (Beloshitskii & Dushkin, 2005; Lightweis, 2013). DI is not simply grouping students of similar academic achievement, as many would assume. Differentiating teaching and learning is a continual process that involves students' learning ability, academic achievement levels, interests, and their learning styles (Tomlinson, 2005). There are many differentiation strategies for teachers to use in the regular classrooms, and it could be complicated or even intimidating to teachers. As indicated by Dr. Carol Tomlinson (Wu, 2013), although it may take some initial time to learn and practice, it would be easier for teachers, once habituated, to use differentiation strategies on a daily basis for their students, including not only gifted students, but all students in regular classrooms.

Academically Gifted & Visual and Performing Arts Gifted

According to the NAGC report State of the Nation in Gifted Education (2013), in 2012-2013, out of the 638,000 students who are in public schools in the State that this study was conducted, 102,695 were identified as gifted education students. Among all the gifted students, the percentage of students who are identified as gifted in Visual and Performing Arts (VPA) areas is not clear. However, as reported in the Critical Evidence published by the National Assembly of State Arts Agencies (Ruppert, 2006), "a May 2005 Harris Poll on the attitudes of Americans toward arts education, commissioned by Americans for the Arts, revealed strong public support" (p. 5). The report shows that 93% of Americans (91% in 2001) agreed that arts were vital to providing a well-rounded education to children. Eighty-six percent agreed that arts education would encourage and assist in the improvement of children's attitudes toward school; and 79% agreed that incorporating arts into education was the first step in adding back what was missing in public education.

A careful search reveals limited research on measurement of the progress of gifted students in VPA. Rubenstein and Wilson (2011) discussed the use of creativity in the classroom. The authors suggested that using creative projects in core content subjects could broaden students' learning tremendously. Teachers of different subjects can plan activities together so they are tying several areas of the same subject together in the same lesson. The authors find that when students feel the activities are engaging, they can exercise their imaginations and problem-solving skills while giving themselves a deeper understanding of the lesson. Another research conducted by Baker (2011) focused on comparing high-stakes test results of eighth grade students and the effects music and visual arts education had on test scores. What Baker found after comparing scores between several groups of students was that students with music education had higher test scores in every group of students in the study. Students who had visual arts education only scored higher in language arts and math in one of the groups. The conclusion of the author is that arts education in general is very important for all students, not just because of higher test scores. The author further pointed out that school policies must be reevaluated to include more arts education in schools to not only improve student retention of information, but make them more well-rounded individuals.

Research has shown relationships among academic giftedness and VPA giftedness. An empirical study conducted by Canada researchers (Upitis, Smithrim, Patterson, & Meban, 2001) included over 100,000 students in their research. The results indicate that there are clear correlations between achievement in mathematics and language and engagement in arts activities, particularly with respect to music lessons. Findings from four longitudinal studies (Catterall, Dumais, Hampden-Thompson, 2012) reveal that "Socially

and economically disadvantaged children and teenagers who have high levels of arts engagement or arts learning show more positive outcomes in a variety of areas than their low-arts-engaged peers" (p. 24). The results indicate that students that have a lower socio-economic background and that have some form of regular arts education perform better in academic areas than students who have less arts education.

Evaluation and Measurement of Progress

The new Common Core State Standards in mathematics and language arts require new assessments for measuring student progress (Johnsen, 2013). It is our understanding that teachers with gifted students need to be evaluated for how they measure these students' progress, just as teachers of special education students need to be evaluated for how they measure progress of students with special needs. Such evaluations should always support continuous improvement, and must be based on multiple reliable measures, which require "professional development opportunities; take into account the special population of children and the range of their exceptionalities; never be based solely on student growth; transparent and consider the expertise of the teacher; and continually incorporate findings from research" (Johnsen, 2013, p. 81).

According to the NAGC-CEC Teacher Preparation Standards in Gifted and Talented Education (2013), gifted students should be assessed regularly for basic skills and knowledge, and should be provided with alternative challenging educational opportunities. The NAGC-CEC Standards further indicate that, when gifted students are not performing or demonstrating their capabilities, they should be provided with specialized intervention services that can challenge them in daily life at school. Through continuous evaluation and measurement of progress, educators will know better whether the gifted students are learning and achieving at the level of potential and even beyond.

Evaluations and identification of students with potential in VPA using specific procedures are rare (Haroutounian, 1995). Further, due to the fewer numbers of identified students in VPA areas, these students have less opportunity in school to have the same experiences with teachers using differentiated materials, lesson plans and teaching strategies. Many teachers may encounter difficulties in differentiation as well as measuring student progress in regular classrooms. It is even more difficult for teachers to differentiate instruction for students with giftedness and talent in visual and performing arts areas and measure their progress.
The first purpose of this study is to understand teachers' awareness of gifted and talented students in their classrooms, including students gifted in VPA areas. The second purpose of the study is to know whether teachers are using differentiated instruction, how they differentiate their teaching, as well as how they evaluate and measure gifted student progress.

Research Method

The first author of this paper chose to use a quantitative approach for this study. Based on ideas and issues related to teaching gifted students in the literature, a simple survey with 9 questions was designed using multiple choices. The questions aim to answer questions such as whether the teachers were aware of the gifted students in their classrooms; if the teachers are receiving professional development from their school districts about gifted education; whether they use differentiated strategies in teaching, and if yes, what strategies they use; and whether they have VPA gifted students and how they evaluate and measure their learning progress.

Participants

Email addresses of teachers in the State were gathered through school email lists. The first author of this project worked at a school, and she wrote a brief invitation letter and sent it to all the email addresses she could gather from all counties in the State. Some of the emails were rejected possibly due to the teachers having left the school system or moved to another school. There were no incentives promised or agreements made to the participants of the survey, except that teachers were promised that a copy of a Classwork Tracking Form for gifted students created by the first author would be sent to them. All participants of the survey were

certified teachers working in a public school system in the State, but since students are identified as gifted only in 4th grade, a request was made in the email that only teachers who had students in grades 4 through 12 complete the survey.

The survey was sent to schools in 120 counties in the State, and responses were collected from 88 counties, or about 73% of all counties contacted. The minimum number of teachers who participated from a certain county is one, and the maximum number of teachers from one county is 64. Some responses skipped one or two of the nine questions, but unless more than four questions were skipped from one individual's response, the response is considered valid and is included in the discussion. The total number of valid teacher responses is 764.

Data Collection & Analysis

A simple Survey Monkey online questionnaire was designed and used to collect the data. Survey Monkey is easy to use and it offers a variety of options for how to arrange the questions. Not only does it allow users to create surveys, it also tallies the results of any survey, allowing users to see the results of each question in visual aids such as charts and graphs, based on the response rate of each choice made by participants. Selections are available to have multiple choices that participants could choose and there are extra boxes for comments. Survey Monkey also offers statistical results of the data collected.

The Survey Monkey questionnaire was collected through a three month period of time. After the first invitation, reminders were sent out twice during the first two months. This survey includes nine questions as it is highly possible that teachers may not have time to take the survey if it is too long or more than one-page long. As shown in Appendix I, the nine questions in the survey are straightforward, as teachers can easily choose one or more answers from the list, and to answer in what county they are teaching. Data analysis and findings will be discussed in the following section.

Results

There were 764 responses collected during three months. Question 1 asked teachers which county they were from. For question 2, there were three teachers who did not answer. Out of 761 responses, about 84% (n=637) of teachers knew that there were gifted students in their classes, and over 16% (n=124) of teachers did not know if they had gifted students in their classrooms at all (see Figure 1 below).

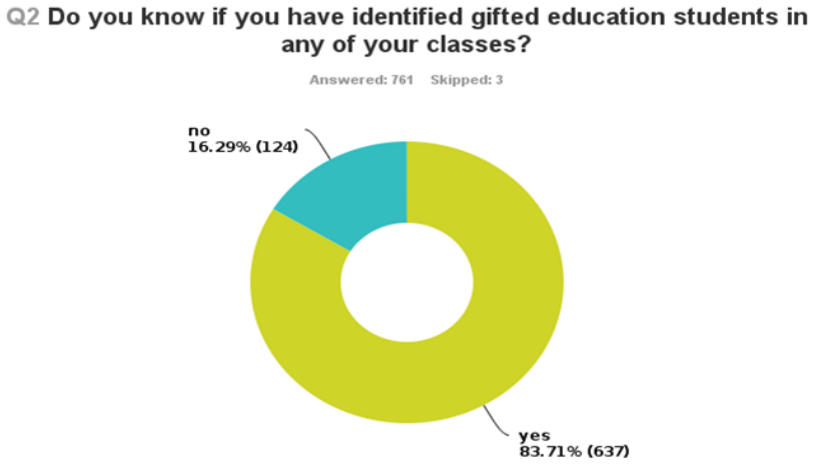

Figure 1. Awareness of Identified Gifted Students

For question 3, while forty-eight teachers skipped the question, about three quarters (76%, n=545) of teachers knew the area(s) of giftedness of their students. 24% (n=171) of teachers did not know the areas of giftedness of their gifted students (see Figure 2 below).

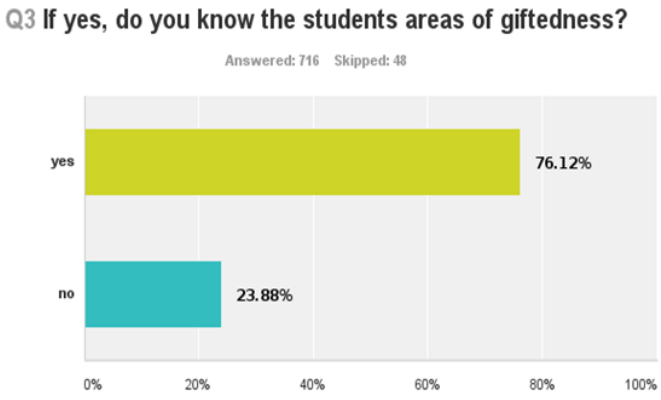

Figure 2. Areas of Giftedness

Question 4 asked teachers to answer if they differentiated instruction with the gifted education students in their classroom including VPA GT students. Twenty teachers didn't answer this question, and among 744 answers, 64% (476) teachers said they did differentiate, 28% (n=208) of teachers said they did not, and about 8% (n=60) of teachers said they were not sure if they differentiated or not (see Figure 3 below).

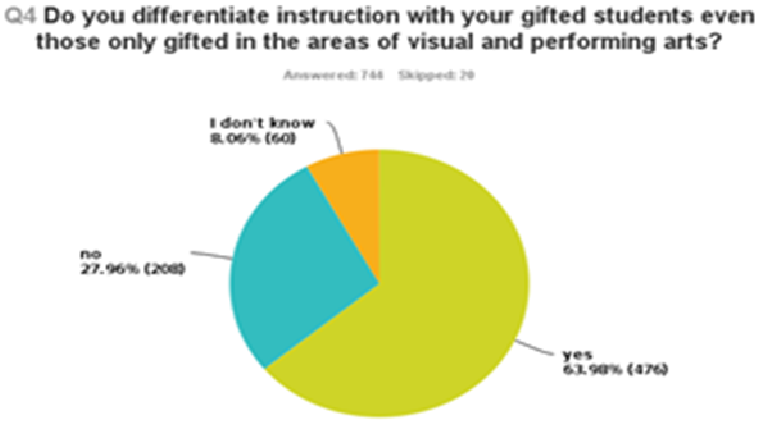

Figure 3. Differentiating or Not

The answers were interesting for Question 5, when teachers were asked how often they employed differentiated instruction in teaching. Twenty-seven out of the 764 respondents skipped the question. 20% out of 737 teachers indicated they differentiated every class period, while 23% differentiated at least once each day. 17% of teachers differentiated once a week, and 18% differentiated a few times each month. Also 17% of teachers indicated they did not differentiate instruction, which is different from the result of question 4 above.

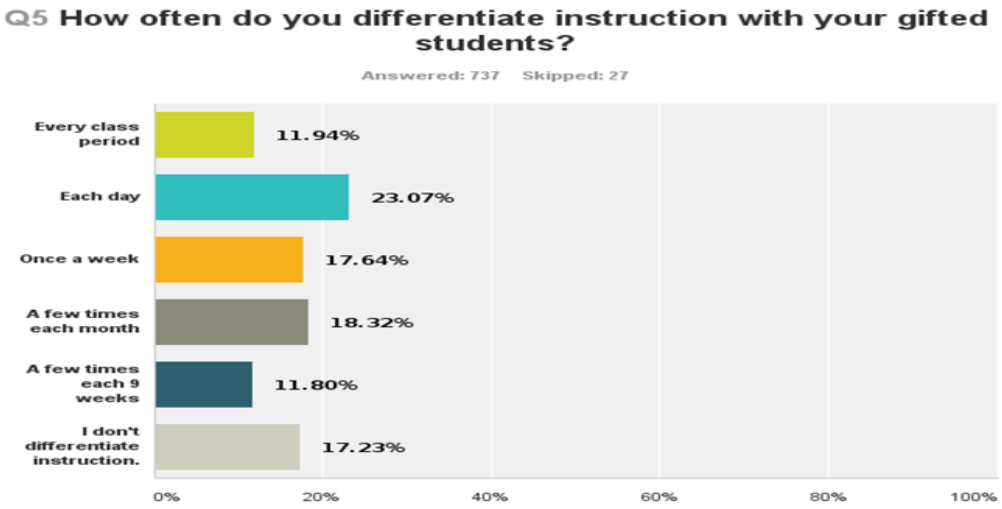

Figure 4. How Often Differentiation Occurs

Question 6 of the survey asked teachers what methods they used when they differentiated instruction. There was a variety of differentiation strategies included for teachers to choose from, and these strategies were chosen because they are teaching strategies teachers use often as seen through literature. The strategy that was selected by the most teachers was flexible grouping. Quite a large number (n=121) teachers skipped this question. Over 66% of the 643 teachers made this choice while 52%-54% selected open-ended questions, student directed learning, and encouraged abstract and complex thought in the classroom (see Figure 5 below).

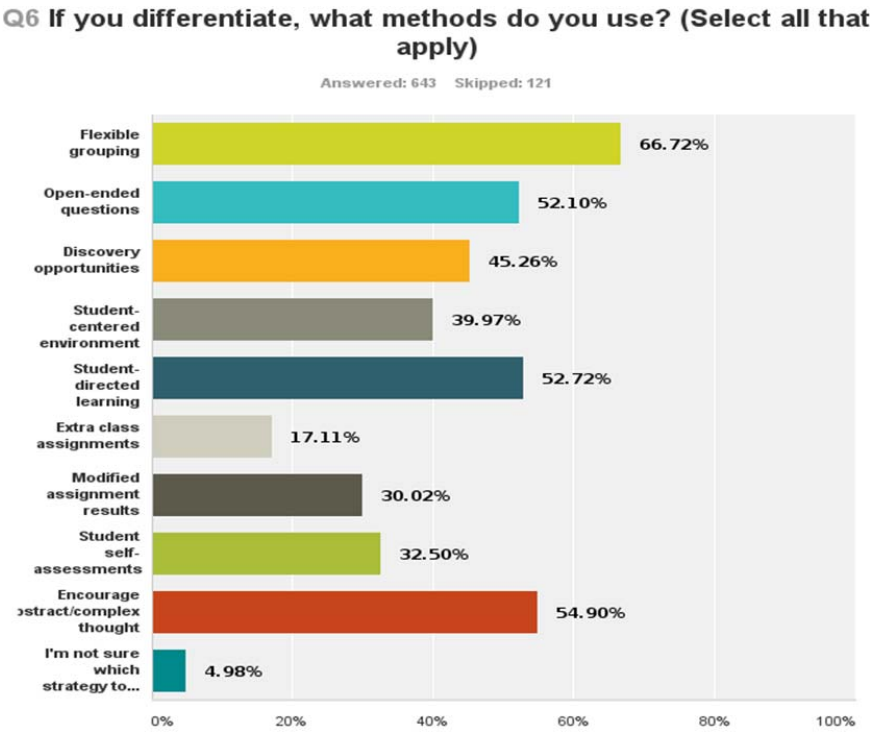

Figure 5. Differentiation Strategies

Question 7 of the survey asked teachers if they had a gifted education teacher in their school who might either lead a pull-out program or had a self-contained class for gifted students. 57% of teachers said they did not have a gifted education teacher in their school, and 42% of teachers said they did have a gifted education teacher.

Question 8 asked teachers if they felt they needed more professional development in their school on gifted education. Over 61% of teachers said yes, they would like to have professional development on differentiation, as their school district did not have any professional development regarding gifted education during the past year. Over 22% of teachers said they would like more even though their school district had already had certain professional development in gifted education. 16% of teachers said they did not need any more professional development on the subject because their school district had already presented some in the past year.

The final question of the survey asked teachers how they evaluated the progress of the gifted education students in their classroom. They were asked to select all answers that applied to their situation (see Figure 6 below). Twenty-nine teachers skipped the question. 70% out of 735 teachers said they evaluated gifted students the same as all other students in their classroom, and only 8% of teachers used a separate portfolio for gifted student evaluation. While 17% of teachers chose that they used different grading criteria, 16%, which is almost the same percentage of teachers who indicated they did not know how they would evaluate the progress of gifted students.

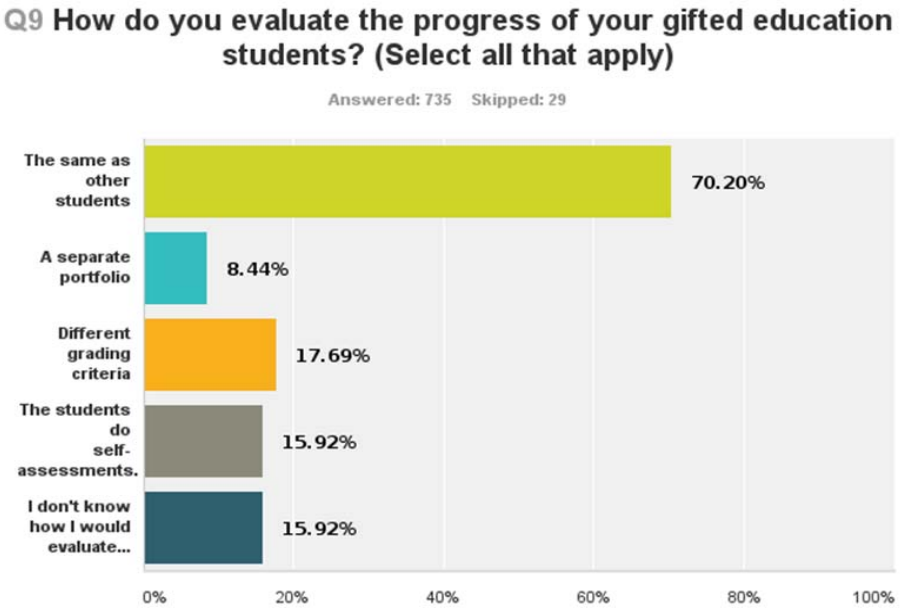

Figure 6. Evaluating the Progress of Gifted Students

Discussion

The survey data yielded some interesting findings, and also pointed out several critical issues that teachers encounter regarding differentiation. The major results and implications are discussed here.

First, from this study with over seven hundred and sixty teachers, although a large percentage of teachers (over six hundred and thirty) are aware of the fact that there are gifted students in their classrooms, many teachers (close to two hundred) did not know the specific areas of giftedness their students have. Differentiated instruction needs to respond specifically to students' readiness and interests (Tomlinson, 2005). If teachers do not know which areas the students are gifted in, it is almost impossible for these teachers to differentiate. Even if they do differentiate their instruction in academic areas, such as math or science, the gifted students may not benefit at all due to their giftedness in other areas, such as language, arts or leadership. It seems that not all

teachers in regular classrooms are trained before or after they start their teaching career. Gifted education needs more attention as in the special education field. Pre-service and in-service teacher training programs are very much in need of professional training on giftedness and differentiation when they pursue their teaching certificates.

Second, among the teachers who differentiated instruction, not many teachers differentiate their instruction regularly. There were only a small percentage of teachers differentiating each day or every class period. Regular and consistent differentiation in classrooms might be time-consuming to some teachers, but small and steady steps can be achieved more reasonably and are more important to keep the effort of differentiation (Heacox, 2009). It is critical to let students understand what teachers are doing, and learn the classroom routine, according to Dr. Carol Tomlinson (Wu, 2013). Learning is a continuous effort for students, and as gifted students have higher levels of readiness and interests, they need regular and consistent support and stimulation in order to learn further and grow. It would be reasonable for us to hope that teachers would understand better the importance of regular practice of differentiation in teaching gifted students within regular classrooms.

Third, teachers use grouping, student-directed learning and open-ended questions more often for differentiation. These are good, but very general strategies that teachers can use for any students, regardless of whether they are gifted or not. These teachers can certainly learn more specific differentiation strategies through further in-service training and professional development. Research finds that a greater number of professional development hours is positively related to higher teacher efficacy and teachers' sense of efficacy beliefs (Dixon, Yseel, McConnell, & Hardin, 2014). Due to the lack of sufficient training and professional development, teachers may not know specific differentiation strategies that can be very helpful and easier to use, such as a learning contract, strategic flexible grouping and tiered lessons (Tomlinson, as in Wu, 2013). Most, if not all, of the counties in this State provide a gifted and talented coordinator for the district, who are often classroom teachers. These coordinators are in charge of identifying students using professional assessment instruments and other data, providing documented opportunities for gifted students, and keeping up with the paperwork required by law. The problem is, with the minimum service, there are not enough or sufficient services to sustain gifted students and provide them the differentiation and stimulation they need to grow their talents.

In addition, systematic evaluation and measurement of the progress of gifted students in learning, including those gifted in VPA areas, is very important. While not many teachers in this study differentiate their instruction very often, even fewer teachers use evaluation tools to regularly monitor their gifted student learning and achievement. Dr. Carol Tomlinson indicated that, "It's pivotally important that you spend time understanding students are progressing in their learning trajectories, so that both informal and formal assessment become central in your work" (Wu, 2013, p.130). Research indicates that the availability and use of formative assessments, along with teachers' high expectations for their gifted students, support teacher efforts in using differentiated instructions (Johnsen, 2013; Missett, Brunner, Callahan, Moon, & Azano, 2014). With systematic assessment of gifted student progress, teachers will know much better the learning levels where these students are currently, and how their special needs should be addressed more appropriately.

Conclusion

This study employed a simply online survey to collect data from over seven hundred 4-12 grade teachers in a State in the mid-south of the United States. Research questions focused on the teacher's awareness of gifted students within the classroom, whether and how they differentiate instruction in the regular classroom, whether they evaluate gifted student progress, and if they need more professional development. It was not surprising that many teachers need to know better the situation of gifted students in their classroom, and what professional development needs to offer more often to teachers. Differentiation strategies and evaluation procedures are also lacking, and teachers have a need to learn more about this important knowledge and the tools within regular education. Specifically, gifted students, including those who are gifted in visual and performing arts, deserve similar attention and treatment as students in special education may receive. Through further professional development and collaborative efforts between teachers and gifted students, these students can develop their full potential and have better opportunities to contribute to society.

Appendix I

A Survey of Differentiating Instruction in Regular Classrooms

1. In what county do you teach?

2. Do you know if you have identified gifted education students in any of your classes?

- yes
- no

3. If yes, do you know the students areas of giftedness?

- yes
- no

4. Do you differentiate instruction with your gifted students who are specifically gifted in the areas of VPA?

- yes
- no
- I don't know

5. How often do you differentiate instruction with your gifted students?

- Every class period
- Each day
- Once a week
- A few times each month
- A few times each 9 weeks
- I don't differentiate instruction.

6. If you differentiate, what methods do you use? (Select all that apply)

- Flexible grouping
- Open-ended questions
- Discovery opportunities
- Student-centered environment
- Student-directed learning
- Extra class assignments
- Modified assignment results
- Student self-assessments
- Encourage abstract/complex thought
- I'm not sure which strategy to use

7. Do you have a gifted education teacher in your school who either has a self-contained class for gifted students or does a pull-out program?

- yes
- no

8. Do you feel you need more professional development regarding teaching gifted education students?

- Yes, our district hasn't had any professional development on gifted education this year.
- No, our district has had professional development on gifted education this year.
- I would like more. Our district has had a small amount of PD on gifted education this year.

9. How do you evaluate the progress of your gifted education students? (Select all that apply)

- The same as other students
- A separate portfolio
- Different grading criteria
- The students do self-assessments
- I don't know how I would evaluate them differently

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Bill Bryson and the Synergy of Data

Michael E. Walters Center for the Study of the Humanities in the Schools

One of the major obstacles that many gifted students struggle with is the organization of their data. This is a special problem in our digital environment. It is easy to assess data but the difficulty occurs with dramatic purpose, evaluation and conceptualization. Bill Bryson has a special genius for creating a narrative and content with his array of wonderful details.

In his recent book, ***One Summer, America 1927*** (2013), he has demonstrated that history is constructed upon details, and it is imperative to create a meaningful narrative. Bryson provides his details with dramatic and philosophical insights. This book concentrates upon events in the year 1927. He does so with such a splendid synergy that all the events of 1927 reverberate with 2016. He gives a description of the weather, e.g., the floods along the Mississippi River that show climate change has always been with us. There is also a discussion of the attempted bank manipulations that produced the Great Depression.

An example of his mastery of linguistics is how he interpreted Shakespeare's significance to English culture. He was not concerned with the details of Shakespeare's life per se, but how he used the English language in such a powerful manner. ***Shakespeare: The World as Stage*** (2008) emphasizes an appreciation for Shakespeare's sensibility which reflected the interaction between his life, intellectual concepts, and emotional responses. It is part of the Eminent Lives Series published by Harper Perennial and edited by James Atlas. Examples of other books in this series are: Christopher Hitchens on Thomas Jefferson, Edmund Morris on Beethoven, and Peter Kramer on Freud.

Bryson edited a wonderful book of essays, ***Seeing Further: The Story of Science, Discovery, and the Genius of the Royal Society*** (2011). These essays stressed how the major scientific discoveries are the result of the scientist's ability to "see further" — the synergy of detail that creates a new scientific paradigm, e.g., Newton's gravity and mathematical reasoning, and Darwin's study of evolution. Bryson's book should be used in gifted programs to enable students to learn that knowledge is driven by groups of exceptional individuals with similar interests, discoveries and abilities.

Books from Gifted Education Press

How an Engineer Uses Math – Real World Practical Examples for the Gifted Classroom in Environmental, Power, and Energy Areas – Middle and High School (2015) by Harry T. Roman.
Excellent introduction to real world math, science and engineering problems.

Giving a Lift to the Gifted: Ideas and Essays for Helping Teachers Inspire Higher Thinking in the Creative Classroom by R.E. Myers (2014). Please see the link at Amazom.com and a picture of the inspiring cover designed for gifted students and their teachers.

***Invention, Innovation and Creative Thinking in the Gifted Classroom* (2014) by Harry T. Roman**
A Unique Book for Teaching Gifted Students How to be Inventors and Innovators – Written by an Inventor and Distinguished Technology Teacher of the Gifted – Harry T. Roman. STRETCH THE INVENTION MENTALITY OF YOUR GIFTED AND ADVANCED STUDENTS!

CREATIVE PROBLEM SOLVING –

Energizing Your Gifted Students' Creative Thinking & Imagination: Using Design Principles, Team Activities, and Invention Strategies - A Complete Lesson Guide for Upper Elementary and Middle School Levels by Harry T. Roman

SNIBBLES: REALLY Creative Problem Solving Lessons and Mind-Stimulating Exercises for Gifted Students and Their Teachers, Ages 5 through Really Old! by Judy Micheletti

STEM/STEAM Education Books –

1. STEM Robotics in the Gifted Classroom: Meet ROBO-MAN! Upper Elementary through Secondary Levels by Harry T. Roman

2. STEM—Science, Technology, Engineering and Mathematics Education for Gifted Students: Designing a Powerful Approach to Real-World Problem Solving for Gifted Students in Middle and High School Grades by Harry T. Roman

3. STEAM Education for Gifted Students! Upper Elementary Through Secondary Levels: Combining Communication and Language Arts with Science, Technology, Engineering and Mathematics by Harry T. Roman

4. STEM to STEAM Education for Gifted Students: Using Specific Communication Arts Lessons with Nanotechnology, Solar, Biomass, Robotics, & Other STEM Topics by Harry T. Roman & Robert E. Myers

LANGUAGE ARTS, HOMESCHOOLING –

Golden Quills: Creative Thinking and Writing Lessons for Middle-School Gifted Students by Robert E. Myers

HOMESCHOOLING GIFTED STUDENTS: Stimulating High Levels of Creative Thinking and Problem Solving in the Home: Upper Elementary through Middle School by Robert E. Myers