# 4th INTERNATIONAL CONFERENCE ON EDUCATION (ICED-2015) The Effect of Training Individuals with Mild Intellectual Disability in Scaffolding Strategies and Computer Software on Their Generalization Skills 2015

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## Abstract

**Objective:** The study aimed at investigating the effect of scaffolding strategies as thinking out loud and verbalization of instructions strategies on the generalization skills of language-related concepts in mildly intellectual disabled students.

**Method:** Twenty-seven subjects in three treatments were trained in solving a pattern of the Thurston letter series task. Group 1 students received language concepts through training in verbal instructions and thinking out loud strategy. Group 2 students received language concepts training through computers. Group 3 students received training in language concepts through thinking out loud, verbal instructions and computer software. Pre-training measures to subjects' chronological age, Verbal Analogies Test and training trials were collected. Training measures pertaining to acquisition, maintenance and generalization of pattern completion tasks were collected. Mean scores and standard deviations were obtained for each dependent measure.

**Results:** The treatment effect was studied by a series of one way ANOVAS and a tukey post hoc test, which revealed that there was a significant difference between group 1 and group 2, since the difference between the means (m1-m3)=-2.556 and p=0.000. Also, the difference is shown between group 2 and group 3 since the difference between the means (m2-m3)=-2.333 and p=0.000 and in both cases p is less than 0.05. Moreover, group 3 had a higher mean (M=3.89) than group 2 (M=1.56) and group 1 (M=1.33).

**Conclusion:** Group 3 had the ability to become self–regulated by solving the untrained letter patterns. Thus, we can conclude that training in scaffolding strategies, such as thinking out loud and verbalization of instruction strategies, helped individuals with an intellectual disability to acquire metacognitive strategies. This enabled them to generalize the learning experience and become self-regulated and better problem solvers. Also, using a computer program promoted the use of metacognitive strategies. Once students internalize target strategies, they can transfer these to second language patterns; therefore, it enhances the generalization of learning individuals with an intellectual disability. Recommendations for further research were discussed.

## Introduction and Background of the Problem

The APA's fifth revision of its DSM-5 and the WHO in the 11th edition of the International Classification of Diseases (ICD-11) revised their terminology [1]. Thus, the ICD-11 working group proposes replacing mental retardation with intellectual developmental disorders (IDDs), a term it defines as 'a group of developmental conditions characterized by significant impairment of cognitive functions, which are associated with limitations of learning, adaptive behavior and skills' [2]. The new term proposed for DSM-5 is intellectual disability (ID/IDD) as used by the American Association on Intellectual and Developmental Disabilities (AAIDD) [1].

Critical components of intelligence proposed in both DSM-5 and the ICD-11 are verbal comprehension, working memory, perceptual reasoning and cognitive efficacy [2]. The diagnosis in DSM-5 will emphasize both clinical judgment and standardized intelligence testing; however, less emphasis is expected to be placed on the IQ score, but greater emphasis will be placed on the adaptive reasoning in academic, social and practical settings. The requirement for both intellectual deficits and adaptive deficits that fail to meet the standards for personal independence are proposed to remain in DSM-5, with greater emphasis on linking intellectual deficits to adaptive deficits through adaptive reasoning in the three domains listed [2].

Based on the impairment of cognitive functions, as mentioned in DSM-5, individuals with intellectual disability are unable to use language and communication to exert control over their environment [3]. In this regard, Vygotsky argues that

cognitive functions such as generalization and abstraction are difficult to carry out in the absence of language [4]. Similarly, Luria [5] links the development of self-regulation to language since they cannot use language efficiently to mediate learning experience. Likewise, Whitman viewed the delayed language development in individuals with intellectual disability as a self-regulatory disorder. Accordingly, "self-regulation strategies allow individuals to set goals for their learning and then attempt to monitor, regulate and control their cognition, motivation and behaviour, guided and constrained by their goals and the contextual features in the environment" [6]. In other words, selfregulated learning is often conceived as a cyclical model (e.g., Zimmerman, 1999). Equally, Winne [7] describes selfregulated learning "as metacognitive governed behaviour where learners adaptively regulate their use of cognitive tactics and strategies in tasks". Hence, an adaptive regulation of selfregulated learning requires goals. In order to perceive discrepancies between a current state and a goal, a learner has to monitor his/her own behaviour. This is related to Bandura's self-regulation theory which emphasizes self-observation, self-regulation, understanding the role of the goals and self-efficiency [8]. Similarly, these ideas are viewed from an information processing perspective, in which self-regulation is the ability to guess the goals, identify the problems, solve them correctly and think critically to reach the objectives [9]. Moreover, self-regulation is based on learning how to generalize concepts and use them in life span [10]. Consequently, working with individuals with an intellectual disability to increase their self-regulation depends on teaching them language concepts, since language helps them to think, solve problems and control themselves [11].

Moreover, Mukallid [12] and EL-Daw [3] stated in their studies that language concepts, such as before/after, between and verbal instructions encourage individuals to become problem solvers in new situations. In fact, intellectually disabled individuals are unable to face a problem and solve it easily. Hence, they need training to help them solve a problem and understand new situations [13]. Training helps them to become problem solvers since they are able to use old information and techniques in new problems [14]. Therefore, the purpose of the study is to examine the effect of scaffolding teaching strategies in training language–related concepts using verbal instructions, thinking out loud strategies and computer software on problem solving and generalization skills in students with an intellectual disability. More specifically, this study was conducted during the academic year 2014-2015 to answer the following hypotheses:

The general hypothesis of the study was that the scaffolding strategies' training will improve the acquisition, maintenance, generalization of pattern completion tasks and help in developing problem solving and generalization skills for individuals with an intellectual disability.

The acquisition of pattern completion tasks, as measured by the number of training trials, will differ in the three treatment groups. Group 1 involves language related concepts training through verbal instructions and thinking out loud strategies. Group 2 involves language related concepts training through computer software. Group 3 involves language related concepts training through verbal instructions, thinking out loud and computer software strategies.

The maintenance of pattern completion tasks, as measured by the number of letters and number of problems will differ in the three groups.

The generalization of pattern completion tasks as measured by the number of problems will differ in the three groups.

## 1.1 Significance of the study

According to Raymond [15], Vygotsky defined scaffolding instruction as the role of teachers and others in supporting the learner's development and providing support structures to get to that next stage or level [15]. As described by Vygotsky, scaffolding instructions are temporary. Chang et al. [16] stated, that as the learner's abilities increase, the scaffolding provided by the more knowledgeable other is progressively withdrawn when the learner is able to complete the task or master the concepts independently. Therefore, Hartman claimed that when using the scaffolding teaching strategy, the student becomes an independent and self-regulating learner and a problem solver. In this regard, Raymond [15] mentioned that the external scaffolds provided by the educator can be removed because the learner has developed more sophisticated cognitive systems, such as language. Hence, the system of knowledge itself becomes part of the scaffold or social support for the new learning [15].

Accordingly, language skills are critical for creating meaning and linking new ideas to past experiences and prior knowledge. According to Vygotsky, internalized skills or psychological tools are used to gain mastery over one's own behavior and cognition [17]. Primary among these tools is the "development of speech and its relation to thought" [17].

Feden et al. [18] maintained that language, as viewed by Vygotsky, plays a central role in cognitive development. Vygotsky argued that language was the tool for determining the ways a child learns 'how" to think'. That is because complex concepts are conveyed to the child through words. Learning, according to Vygotsky [19], always involves some type of external experience being transformed into internal processes through the use of language [18]. Moreover, speech and language are the primary tools used to communicate with others, promoting learning.

Akhutine et al. claimed that language is the primary means of communication that helps every human being to think, build ideas, control behavior and increase self-esteem. Also, Alkamesh [20] stated that individuals with an intellectual disability face several problems in using language and communicating with others in the environment. In this regard, many researchers, such as Vygotsky [19] and Luria [5], believe that language is related to self-regulation. One of the essential main beliefs of the individuals' mental development is based on the process of objective activity and communication with adults [5]. Others insist that intellectually disabled individuals cannot use language easily to communicate and learn how to be self-regulated. So, it is necessary to work with them to

teach them how to be independent and self-regulated [21]. Therefore, Schunk et al. [22] mentioned that self-regulation strategies help intellectually disabled individuals to estimate their behaviour, work independently, generalize and develop their cognitive functions. Accordingly, Kotik-Friedgut [23] emphasized that training intellectually disabled individuals is precious, since it helps them establish concepts and use them in real life independently.

As a result, language plays a basic role in developing self-regulation and generalizing behaviours, especially with intellectually disabled individuals.

## 1.2 Description of key terms

**Scaffolding instruction:** It is a teaching strategy originating from Lev Vygotsky's sociocultural theory and his concept of the 'zone of proximal development' (ZPD). "The zone of proximal development is the distance between what children can do by themselves and the next learning that they can be helped to achieve with competent assistance" [15]. The scaffolding teaching strategy provides individualized support based on the learner's ZPD [16]. In scaffolding instruction, a more knowledgeable other provides scaffolds, or supports, to facilitate the learner's development. In this study, scaffolding instructions represent direct instructions to model the trainer's thinking out loud strategy and to verbalize thoughts while solving the Thurston series completion tasks.

**Language concepts:** DISTAR language is an acronym for Direct Instruction System for Teaching Arithmetic and Reading, a trademarked program of SRA/McGraw-Hill, a commercial publishing company. The program is used particularly for historically disadvantaged and/or at-risk students. It is used in this study to teach the individuals some concepts, such as same/different, in front of, before/after and between, until the main concepts are achieved. These concepts help the individuals understand strategies to solve problems [24].

**Problem solving:** This section increases the individuals' capacity to plan, think and predict to solve any problem and reach the goal. It helps the individuals examine their behaviour while learning and discovering new concepts. In this study, subjects are required to solve patterns using letters [5].

**Pattern completion tasks:** The Thurston series completion tasks are used in this study. Therefore, individuals learn to solve and discover certain patterns using letters according to a specific system [5].

**Thinking out loud strategy instruction:** The strategy here is solving an identity pattern, which is the repetition of the letters according to a specific rule. Individuals should discover the rule and continue the pattern correctly among the letters in the alphabet. For example, to solve the identity pattern, the trainer should teach the individuals how to discover the rule by reading it out loud and knowing the order of the letters [25].

**Maintenance:** It is the process in which the learners keep hold of information to be used in different circumstances. It shows when the learners recognize and transform their ideas

in the given materials and strategies [26]. In this study, subjects are asked to solve 6 problems under the identity pattern [24].

**Generalization:** This step includes the ability of subjects to recognize the fact that same situations require same responses and that different situations require different responses. So, individuals will be able to solve untrained situations/patterns correctly after training the general rule of the identity pattern [27]. In this study, generalization is defined as the ability of students to solve untrained and more complex patterns.

# Method

## 2.1. Subjects

The subjects in this study were 27 educable, mild intellectually disabled students. Subjects were selected randomly from a special education school in Beirut, Lebanon. The school is functioning primarily on the contributions of social organizations and charity donations. Most subjects represented a low range of the social economic continuum in Lebanon. The mean age of the samples across all experimental conditions is 10.33. Subjects were assessed by a clinical psychologist to measure their IQ's, as revealed in their school profiles, which ranged between 55 and 75 on a modified version of the WISC culturally adapted for the use with Lebanese children. This means that they can acquire knowledge and languages. Subjects did not have any speech problems and had acquired the Arabic alphabet **(Table 1)** [24].

**Table 1:** Description of sample.

| Age | Frequency | Percentage |
| --- | --- | --- |
| 9 | 4 | 14.8 |
| 10 | 13 | 48.1 |
| 11 | 7 | 25.9 |
| 12 | 3 | 11.1 |
| Total | 27 | 100 |

## 2.2. Procedure

**Assignment of subjects to groups:** The subjects in this study were assigned at random to three groups before training. Group 1 students received the language concepts through verbal instructions. Group 2 students received language concepts through computers. Group 3 students received the language concepts through verbal instructions and computers.

**Trainer:** The trainer was a female graduate from the Lebanese University, Faculty of Education-Deanery, working towards her master's degree in special education during the academic year 2014-2015. Training with the subjects was conducted once per week for 45 minutes over 2 months. Subjects were trained in language concepts and patterns completion. The training process was supervised and controlled by an educational psychologist, the researcher. This

study was divided into three phases: Pre-strategy; strategy training and maintenance testing; post-strategy training or testing for generalization.

**Reinforcement:** Reinforcement learning is learning what to do and how to map situations to actions. Individuals are not told which actions to take. They must discover the correct ones. In this study, there are different methods of reinforcement. Using the computer, such as games, videos and songs, is one of the basic reinforcements that helps individuals enjoy learning and become more interested in what they are doing. In addition, stickers, gifts (pencils, erasers, sharpeners) and reward charts were used. Videos, games and songs are used after each session. Stickers are used according to the student's answers during the session and when they collect 10 stickers, they choose a gift. Each group in this study has its own reinforcement tools. Group 1 has stickers, reward charts and gifts. Group 2 has videos, songs and computer games. Group 3 has stickers, reward charts, gifts and the computer [24].

**Per training measures:** Descriptive statistics were obtained on subject's ages, verbal analogies test score, letter recognition scores and pattern completion task scores.

## 2.3. Description of phases

Following [3, 12], the study was divided into three phases: pre-strategy, strategy training and maintenance testing, post-strategy training or testing for generalization.

Phase I shows the language training. After different assessments, the trainer taught each group, with 9 students in each group, for 20 minutes per week until the subjects could recognize the following concepts: Same/different, before/after and between. The training was performed after coordinating with the school's principal and teachers.

Phase II represents the training and maintenance testing, in which the trainer worked with the students in group activities at first, then with each student individually. In this phase, students were taught 6 letters for 20 minutes per week and then were asked to identify the pattern using big flashcards and games.

Phase III represents testing the generalization after the maintenance phase, through working individually with each student that had a test of 4 identity pattern problems.

## 2.4. Description of materials

Certain sections of the Distar Language I program [3, 12] were used for the language related concepts training. The following Distar language concepts (same, different, before, after and between) were trained to teach pattern completion tasks [12]. Also, Arabic letters in the form of an alphabet train, flash cards, toys and games were used to teach the subjects Arabic letters. Pattern completion tasks, games and toys were used first. Then, the Arabic alphabets were used so they can form and complete the patterns according to the alphabet in the form of a train [24]. This material is basically a series of exercise sheets with pictures and questions arranged to allow

scaffolding instructions, direct teaching and practice so that mastery of the taught concepts was achieved. Hence, the trainer uses direct instructions and gives an opportunity for students to think out loud and verbalize their answers. The trainer will guide independent practice using corrective feedback and reinforcement. This program builds up high levels of gaining time and increasing students' motivation [28]. In this study, subjects were taught the concepts before/after, between, in front of and same/different using educational games, pictures, worksheets and videos.

**Verbal analogies test:** It is a sub-test used as an intelligence scale for Lebanese children [29]. It was standardized for the Lebanese children between 4-12 years. This test measured one kind of logical reasoning among children. The child was given a part of a sentence and she should continue the second part with a logical answer based on the first part. For example, my mom is a woman, my dad is a……………… This test was applied verbally on each student individually.

**Pattern completion tasks:** In this study, the Thurston letter series was used to teach the subjects to learn how to discover the pattern and solve it using letters. The task, as described by Kotovesky and Simon, requires the learner to discover the pattern in each string and expand upon it. Kotovesky and Simon demonstrated that three alphabetic rules were employed in this task: Identity (I), Next (N), and Backward-next. The identity (I), where a letter is repeated, reflects the concept 'same'. The subjects should continue the pattern correctly, such as ABAB………, in which the two letters A and B were repeated. The next (N) pattern, where the next letter in the alphabet occurs, was also taught. This reflects the regular relation of letters to each other in the alphabet. Pre-training of the identify pattern took place to ensure the treatment effect. Then, in the maintenance phase, testing 6 patterns were used with specific letters. In addition, 4 patterns were used in the generalization. Testing differed from those who used training and maintenance testing in letters and task demand. Two were constructed by Mukallid [12] related to alphabetical letters and the remaining two were constructed by Jalloul [24] general (boy, girl...).

**Scaffolding Instructions:** A set of problem solving instructions was prepared and reported in Mukallid's study for solving the two training patterns (I) and (N). Instructions are based on Simon's [12] and Batterfieled's analysis of the rules for solving letter series. The problem solving strategies were applied with the 3 groups, in which they should discover the relation between the letters given in order to solve the pattern correctly. This was taken from Mukallid's [12] study for solving the identified pattern. The same concepts and patterns were taught to the three groups, but it differs in the way it was given to each group (verbal instruction, computer, verbal instruction and computer at the same time).

# Variables

## 3.1. Independent variables

The type of instruction involves three levels:

Group 1 students received language concepts through verbal instructions.

Group 2 students received language concepts through computers.

Group 3 students received language concepts through verbal instructions and computers.

## 3.2. Dependent measures

**Acquisition:** It was measured by the number of training trials required by the acquisition of each one of the trained patterns.

**Maintenance:** It was measured by the number of letters correctly filled in the right blank for each of the tested patterns and the number of problems solved correctly by each of the tested patterns.

**Generalization:** It was measured by the number of problems solved correctly by each one of the tested patterns.

## 3.3. Scoring and data analysis

The number of training trails for acquisition was counted for each subject on each of the trained patterns. The number of letters and the number of problems filled correctly by each subject was counted for the trained patterns on the maintenance and generalization testing.

Descriptive statistics were obtained on each of the dependent measures. Separate one way analysis of variance was performed on each dependent measure (acquisition, maintenance and generalization). Every one way analysis of variance was followed by t-test to compare the effects of pairs of treatments.

# Result and Discussion

The general expectation in this study was that students who received language related concepts training through scaffolding instructions by means of thinking out loud, verbal instructions and computers showed better maintenance and generalization performance on pattern completion tasks than the students who received language concepts through computers or verbal instructions.

## 4.1. Pretraining measures

The samples of this study were 27 students, whose age ranged between 9 and 12 and their mean age is 10.33, with a mild intellectual disability. Pre-training results relating to Atiyeh's test, a verbal analogy test (VAT), letter acquisition and problem solving showed that there was no significant difference among the three groups. Atiyeh's verbal analogy test (VAT) was administered to students prior to training experience to test the difference in their verbal reasoning ability. Results showed that there is no significant difference among the 3 groups concerning the verbal analogies test grade as determined by the one way ANNOVA; group 1 (M=23.33, SD=1.87), group 2 (M=24.22, SD=1.302), group 3 (M=24.22,

SD=1.093), df=(2, 24), f=1.113 and p=0.345 which is greater than 0.05.

Regarding the number of letters and number of problems solved before training, one way ANOVA revealed df=(2, 24), f=0.242 and p=0.787 which is greater than 0.05.

Also, results indicated that there is no significant difference among the 3 groups regarding the number of patterns filled correctly before training. One way ANOVA revealed df=(2, 24), f=0.125 and p=0.883, which is greater than 0.05. Accordingly, results regarding acquisition, maintenance and generalization of letters were caused by the treatment given to each group, such as the presence or absence of the use of computers or verbal instructions.

**Table 2:** Pretraining measures: Verbal Analogy Test (VAT) [24].

|  | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| 1 | 9 | 23.33 | 1.871 | 21 | 26 |
| 2 | 9 | 24.22 | 1.302 | 22 | 26 |
| 3 | 9 | 24.22 | 1.093 | 23 | 26 |
| Total | 27 | 23.93 | 1.466 | 21 | 26 |

## 4.2. Training measures

**Acquisition:** Results in **Table 2** revealed a significant difference among the groups regarding the acquisition. A tukey post hoc test revealed that there was a significant difference between group 1 and group 2, since the difference between the means is (m1-m3)=-4.000 and p=0.000. Also, the difference is shown between group 2 and 3 since the difference between the means is (m2-m3)=-3.778 and p=0.000 and in both cases p is less than 0.05. Findings indicated that group 1 students needed more training trials in order to solve the letter pattern correctly, similar to group 2 who received concepts through computers. The reason for such results is the fact that group 1 needed more motivation and practice through computers and group 2 faced problems in using and working on the computer. On the contrary, group 3 had the chance to receive concepts through computer and verbal instruction at the same time. This showed that students with a mild intellectual disability are capable of acquiring these concepts when they are trained in two ways, verbal instruction and computer **(Table 3)** [24].

## 4.3. Maintenance

Results in this study confirmed a significant difference among the three groups regarding the number of letters and problems solved correctly, since p was equal to 0.000 which is less than 0.05.

**Number of letters:** Results proved that there was a significant difference among the three groups regarding recognition of letters. Statistical analysis showed the difference among the groups; df=(2, 24), f=54.578 and p=0.000, which is less than 0.05. Also, **Table 4** represents a

tukey post hoc test which shows that there was a significant treatment effect between group 3 (M=4.89) and group 1 (M=1.00), since (m1-m3)=-4.000 and p=0.000. Also, the difference is shown between group 2 and 3, since the difference between the means (m2-m3)=-3.778 and p=0.000 and in both cases p is less than 0.05. Moreover, statistical analysis in **Table 5** shows that group 3 had a higher mean score (M=4.89) than group 2 (M=1.00) and group 1 (M=0.89). This, also, insists on the difference between the groups. So, these results proved that group 3 students acquired metacognitive skills when they were instructed to think aloud and verbalize their strategies of thinking while using computers.

**Table 3:** A tukey post hoc test: group I-group J.

| (I) group | (J) group | Mean Difference (I-J) | Sig. |
|---|---|---|---|
| 1 | 2 | -0.222 | 0.864 |
|   | 3 | -4.000[*] | 0 |
| 2 | 1 | 0.222 | 0.864 |
|   | 3 | -3.778[*] | 0 |
| 3 | 1 | 4.000[*] | 0 |
|   | 2 | 3.778[*] | 0 |

**Table 4:** Tukey post hoc test of maintenance: letters acquisition [24].

| (I) groups | (J) groups | Mean Difference (I-J) | Sig. |
|---|---|---|---|
| 1 | 2 | -0.222 | 0.864 |
|   | 3 | -4.000[*] | 0 |
| 2 | 1 | 0.222 | 0.864 |
|   | 3 | -3.778[*] | 0 |
| 3 | 1 | 4.000[*] | 0 |
|   | 2 | 3.778[*] | 0 |

**Table 5:** Maintenance letters filled correctly [24].

|   | N | Mean | Std. Deviation |
|---|---|---|---|
| 1 | 9 | 0.89 | 0.782 |
| 2 | 9 | 1 | 0.707 |
| 3 | 9 | 4.89 | 1.616 |
| Total | 27 | 2.26 | 2.177 |

This point has been proven by researchers, such as Rousan [30], who demonstrate that students with an intellectual disability have the ability to acquire and maintain the trained strategies. Otherwise, Schunk [4] indicates that students with a mild intellectual disability can maintain the trained skills over

two years when they are trained in a metacognitive strategy in a classroom setting.

**Table 6:** Tukey post hoc test; maintenance: problem solving [24].

| (I) groups | (J) groups | Mean Difference (I-J) | Sig. |
|---|---|---|---|
| 1 | 2 | 0.444 | 0.796 |
|   | 3 | -3.111[*] | 0 |
| 2 | 1 | -0.444 | 0.796 |
|   | 3 | -3.556[*] | 0 |
| 3 | 1 | 3.111[*] | 0 |
|   | 2 | 3.556[*] | 0 |

**Table 7:** Number of problems solved correctly.

|   | N | Mean | Std. Deviation |
|---|---|---|---|
| 1 | 9 | 2.22 | 1.563 |
| 2 | 9 | 1.78 | 1.856 |
| 3 | 9 | 5.33 | 0.707 |
| Total | 27 | 3.11 | 2.136 |

**Number of problems:** Results in **Table 6** showed that there was a significant difference among the three groups concerning maintenance in solving pattern completion tasks, since df=(2, 24), f=15.861 and p=0.000 which is less than 0.05. Also, a tukey post hoc test revealed that there was a significant difference between group 1 and group 3, since the difference between their means is (m1-m3)=-3.111 and p=0.000. Also, the difference is shown between group 2 and group 3, since the difference between their means is (m2-m3)=-3.556 and p= 0.000 and in both cases p is less than 0.05. Moreover, **Table 7** proved that group 3 has a higher mean (M=5.33) than group 1 (M=2.22) and group 2 (M=1.78). This can be attributed to the scaffolding instructions. In fact, group 3 has acquired metacognitive skills, which helped them solve the pattern correctly, since they were instructed to verbalize the strategy and apply the strategy using computers. So, group 3 became better in solving problems than other groups who received concepts through verbal instructions or computers. As the learner's knowledge and learning competency increases, the educator gradually reduces the supports provided [31]. Raymond [15] reported that Vygotsky viewed the external scaffolds provided by the educator that can be removed because the learner has developed more sophisticated cognitive systems and related to fields of language learning. Consequently, the system of knowledge itself becomes part of the scaffold or social support for the new learning.

The foundation for scaffolding instruction is related to Vygotsky's concept of the zone of proximal development (ZPD). The ZPD can be described as the area between what a learner can do independently (mastery level) and what can be accomplished with the assistance of a competent adult or peer

(instructional level) [31]. Moreover, Vygotsky believed that any child could be taught any subject effectively using scaffolding techniques by applying the scaffolds at the ZPD. Jaramillo stated that teachers activate this zone when they teach students concepts that are just above their current skills and knowledge level. This motivates them to excel beyond their current skills' level. In addition, Raymond [15] pointed that students are guided and supported through learning activities that serve as interactive bridges to get them to the next level. As a result, the learner develops or constructs new understandings by elaborating on their prior knowledge through the support provided by more capable others. Moll [32] stated that Vygotsky considered the capacity to teach and benefit from instructions is a fundamental attribute of human beings. Also, Vygotsky noted that a child, whose development is impeded by a disability, is not simply a child less developed than his peers; rather, he has developed differently [32]. Tudge [33] stated that when referring to the education of children with disabilities, Vygotsky pointed out that changes in the context of education may have profound consequences for the developmental processes. In this regard, research findings have actually shown that learning and development are hindered in the absence of guided learning experiences and social interaction.

### 4.4. Post training measures

**Generalization:** Our findings concerning generalization gains due to language related concepts training were in favor of group 3, who received concepts through verbal instructions and computes. In this regard, Vygotsky believes that students should be taught how to think and organize their ideas and thoughts to apply them in the environment. The cognitive growth that students should gain is based on their self-regulation since it is the basic root that develops ones' inner processes. Students need scaffolding instructions in order to verbalize their thoughts through self-directed language so they can be used later to direct their behaviour.

**Number of problems:** These results can be explained in terms of metacognitive skills learned through scaffolding instructions, which allow students to become better problem solvers. In **Table 9**, statistical analysis indicated that there was a statistically significant difference among the three groups according to the number of problems filled correctly, since df=(2, 24), f=22.651 and p=0.000 which is less than 0.05. Also, a tukey post hoc test **(Table 10)** revealed that there was a significant difference between group 1 and group 2, since the difference between their means was (m1-m3)=-2.556 and p=0.000. Also, the difference is shown between group 2 and group 3, since the difference between the means (m2-m3)=-2.333 and p=0.000 and in both cases p is less than 0.05. Moreover, group 3 had a higher mean (M=3.89) than group 2 (M=1.56) and group 1 (M=1.33), as shown in **Table 3**. So, group 3 had the ability to solve the letter patterns and become a problem solver with a regulated self. This is proved in [3] researches in which students with an intellectual disability have the ability to generalize knowledge and solve any problem. Therefore, we conclude that group 3 students showed better performance on problem solving when they

were trained through verbal instructions and computers at the same time. Based on this, we can say that students with a mild intellectual disability can acquire language related concepts and use them to improve their self-regulation. In addition, they have the ability to generalize performance on problem solving tasks. A necessary condition for emergence of self-regulation is based on the children's learning of specific cultural tools that would allow them to eventually use self-regulatory behaviours independently. Among the first such tools children learn is self-talk or 'private speech' [34]. Vygotsky's findings suggest methodological procedures for the classroom. In Vygotskian perspective, the ideal role of the teacher is to provide scaffolding (collaborative dialogue) to assist students on tasks within their zones of proximal development [17]. During scaffolding, the trainer in this study built, at first, the students' interest in order to engage them in learning. Once the learner is actively participating, the given task should be simplified by breaking it into smaller subtasks. Vygotsky stated that, during this task, the teacher needs to keep the learner focused, while concentrating on the most important ideas of the assignment. One of the most integral steps in scaffolding consists of keeping the learner from becoming frustrated. The final task associated with scaffolding involves the teacher modelling possible ways of completing tasks, which the learner can then imitate and eventually internalize. To be successful in school, the child has to develop general social and cognitive competencies that will allow him/her to become a deliberate, self-regulated learner capable of establishing adequate social relationships with other participants in the teaching and learning process, as well as being able to adopt a specific position of a "student" characterized by such things as interest in the very process of learning, willingness to play by the school rules, readiness to follow the teacher's directions, etc. [35].

According to Feden et al. [18], Vygotsky placed a great emphasis on the importance of spoken language in his theories. Arguably, this is the most critical tool that sets us apart from other species. He stated that speech is a very powerful psychological tool that lays the foundation for basic structures of thinking later in one's development. Furthermore, Vygotsky [34] mentioned that speech is the first psychological tool used by children to communicate with others who share the environment. Naturally, this is continued through adulthood, as speech is a primary tool used for learning. Vygotsky insists that humans learn best in cooperation with other humans (**Table 8**).

## Limitations of the Study

This study was limited to the chosen sample of Lebanese students with mild intellectual disability (27 student), used instruments (Thurstone series, Distar Language, Pattern completion tasks, scaffolding instructions, Atiyeh's Verbal analogy Test (VAT) and design method as well as the conducted procedure. For this reason, we cannot generalize

the results of this research due to the short number of the sample.

**Table 8:** Post training: generalization number of patterns filled correctly [24].

|  | N | Mean | Std. Deviation |
|---|---|---|---|
| 1 | 9 | 1.33 | 0.866 |
| 2 | 9 | 1.56 | 1.236 |
| 3 | 9 | 3.89 | 0.333 |
| Total | 27 | 2.26 | 1.457 |

**Table 9:** Generalization skills in the three groups [24].

|  | Df | F | Sig. |
|---|---|---|---|
| Between Groups | 2 | 22.651 | 0 |
| Within Groups | 24 | - | - |
| Total | 26 | - | - |

**Table 10:** Tukey post hoc test [24].

| (I) groups | (J) groups | Mean Difference (I-J) | Sig. |
|---|---|---|---|
|  |  |  |  |
| 1 | 2 | -0.222 | 0.858 |
|  | 3 | -2.556[*] | 0 |
| 2 | 1 | 0.222 | 0.858 |
|  | 3 | -2.333[*] | 0 |
| 3 | 1 | 2.556[*] | 0 |
|  | 2 | 2.333[*] | 0 |

## Summary

The general hypothesis of the study was that the scaffolding strategies training will improve the acquisition, maintenance and the generalization of pattern completion tasks and help in developing problem solving and generalization skills for individuals with an intellectual disability.

In this study, there were different hypotheses to be proved such as:

The acquisition of pattern completion tasks, as measured by the number of training trails, will differ in the three treatment groups. Group 1 involved language related concepts training through verbal instructions and thinking out loud strategies. Group 2 involved language related concepts training through computer software. Group 3 involved language related concepts training through verbal instructions, thinking out loud and computer software strategies.

The maintenance of pattern completion tasks, as measured by a-number of letters and b-number of problems will differ in the three groups.

The generalization of pattern completion tasks as measured by the number of problems will differ in the three groups.

As a summary, the methodology that was used with subjects started with the division of the groups: Group 1 students received language concepts through verbal instructions. Group 2 students received language concepts through computers. Group 3 students received language concepts through verbal instructions and computers. Then, Distar language I was used to teach them concepts such as same/different, before/after, in front of and between.

Data was collected before training to check their age and their IQ through the verbal analogy test. A series of one way ANOVA and a tukey post hoc test was used for statistical analysis to investigate any significant difference between group 1, group 2 and group 3 in the training steps to examine the acquisition and the maintenance and generalization of pattern completion task.

We can conclude that there was no difference among the three groups in the pre-training steps, which includes the verbal analogies test, number of letters and the numbers of letter patterns that were filled correctly. However, there was a significant difference in the training step among the 3 groups in the acquisition of the letters. Group 3 was the best group in acquiring the letters during training. Also, the third group in the maintenance step had the ability to recognize the letters and solve the letter problems easily whereas the other two groups faced difficulties.

At the end, in the post training step, group 3 also had the ability to become self-regulated and a better problem solver than the other groups, since the students received the language concepts through computers and verbal instructions at the same time. Thus, we can conclude that training students with an intellectual disability in scaffolding instructions can enhance their generalization skills, as language was the tool for determining the ways a student learns 'how' to think. That is because complex concepts are conveyed to the students through words. Learning, according to Vygotsky, always involves some type of external experience being transformed into internal processes through the use of language. It follows that speech and language are the primary tools used to communicate with others and promote learning. Guided by several specific Vygotskian principles [34, 36], results can be explained by the fact that children's self-regulatory abilities originate in social interactions and only later become internalized and independently used by children. This embeddedness means that to develop self-regulation, children need to have an opportunity to engage in other regulation. Other-regulation implies that children act both as subjects of another person's regulatory behaviours and as actors regulating another person's behaviours. Teachers or more capable peers can raise the student's competence through the zone of proximal development (ZPD). The zone of proximal development works in conjunction with the use of scaffolding. The use of language related concept in this study is essential to successfully implementing scaffolding as a learning tool. Finally, the University of Iowa (2007) suggested that learning to master tools and technologies should also be included in

the curriculum. Students should be taught how to use tools such as the computer, resource books and graphs in order to better utilize these tools in the future. In this way, Hamilton et al. [17] claimed that students will benefit, as these tools and technologies influence the individual's thinking (along with the development of language).

# Recommendations for the Future Researches

Results of this study raised several questions and recommendations that could be followed up in the future. They are listed as follows: future research is needed to examine the basic role of interactive white boards as a way of teaching language to increase the writing skills in individuals with an intellectual disability in inclusive classrooms. Another research is needed to determine the role of the teachers' qualifications in promoting the critical thinking in reading comprehension for individuals with a learning disability using assistive technology in inclusive classrooms. Furthermore, a research is needed to examine the effect of language related concepts training on solving problems in activities that require social interactions such as sharing meals, going in a trip, etc. Finally, a research is needed to determine the effect of scaffolding instructions training on the generalization of social skills in individuals with a mild intellectual disability.

# References

1. American Psychiatric Association (2013) Diagnostic and statistical manual of mental disorders (5th edn.) Washington, DC.

2. Carulla SL, Reed GM, Aziz VLM, Cooper SA, Leal RM, et al. (2011) Intellectual Developmental Disorders: Towards a New Name, Definition and Framework for 'Mental Retardation/Intellectual Disability in ICD-11.

3. El-Daw, Nour BM (1997) The Effect of Language Related Concepts Training and Verbal Instruction on Self-regulated Problem Solving in Mildly Mentally Retarted Students.

4. Schunk DH (1991) Learning Theories: An Educational Perspective.

5. Luria AR (2002) LS Vygotsky and the Problem of Functional Localization.

6. Pintrich PR, Boekaerts P, Zeidner M (2000) The Role of Goal Orientation in Self-regulated Learning.

7. Winne PH (1996) A Metacognitive View of Individual Differences in Self-regulated Learning.

8. Bandura A (1997) Self-efficacy: The Exercise of Control. Conrsini Encyclopedia of Psychology.

9. Lutz S, Huitt W (2003) Information Processing and Memory: Theory and Application.

10. Ablard KE, Lipschultz RE (1998) Self-regulated Learning in High Achieving Students. Journal of Educational Psychology 1: 90-94.

11. King BH, State MW, Shah B (1997) Mental Retardation: A Review of the Past 10 Years.

12. Mukallid HS (1991) The Effect of Language Related Concepts Training and Verbal Instruction of Self-regulated Problem Solving in Mildly Mental Retarted Students.

13. Armatas V (2009) Mental Retardation: Definitions, Etiology, Epidemiology and Diagnosis. J Sport Health Res 1: 112-122.

14. Batshaw ML, Perret YM (1992) Children with Disabilities: A Medical Primer.

15. Raymond E, Pearson A (2000) Cognitive Characteristics: Learning with Mild Disabilities, p: 384.

16. Chang K, Chen I, Sung Y (2002) The Effect of Concept Mapping to Enhance Text Comprehension and Summarization. The Journal of Experimental Education 71: 5-23.

17. Hamilton R, Ghatala E (1994) Learning and Instruction.

18. Feden PD, Vogel RM (1993) Methods of Teaching: Applying Cognitive Science to Promote Student Learning.

19. Vygotsky LS (1962) Thought and Language Cambridge.

20. Alkamesh M (2011) Mental Retardation. Amman Almassera.

21. Vygotsky LS (1997) The History of the Development of Higher Mental Functions. The Collected Work of Vygostky.

22. Schunk DH, Zimmerman BJ (1998) Self-regulated Learning from Teaching to Self-reflective Practice. Self-regulated Learning from Teaching to Self-reflective Practice. Guilford Press, New York.

23. Friedgut BK (2006) Development of the Lurian Approach: A Cultural Neuro-Linguistic Perspective. Neuropsychology Review 16: 43-52.

24. Jalloul F (2015) The Impact of Training Students with Mild Intellectual Disability in Computer Language-Related Concepts and Verbal Instruction Teaching Methods on their Self-regulation.

25. Kay B (1999) How to Assess Authentic Learning.

26. Nikhil L (2009) Improving Effectiveness of E-Learning in Maintenance Using Interactive 3D.

27. Fouse B, Wheeler M (1997) A Treasure Chest of Behavioral Strategies for Individuals with Autism.

28. WWC Intervention Report (2007) Distar Instruction, DISTAR and Language for Learning.

29. Atiyeh N (1972) Intelligence Scale for Lebanese Children.

30. Rousan F (2013) The Psychology of Special Students.

31. Ellis E, Larkin M, Worthington L (2002) Executive Summary of the Research Synthesis on Effective Teaching Principles and the Design Quality Tools for Educators.

32. Moll L (1990) Vygotsky and Education: Instructional Implications and Applications of Sociohistorical Psychology.

33. Tudge J, Moll LC (1990) Vygotsky, The Zone of Proximal Development and Peer Collaboration: Implications for Classroom Practice. Vygotsky and Education: Instructional Implications and Applications of Sociohistorical Psychology, MA: Cambridge University Press, pp: 155-172.

34. Vygotsky LS, Cole M, Steiner JV, Scribner S, Souberman E (1978) Mind in Society: The Development of Higher Psychological Processes.

35. Karpov YV (2005) The Neo-Vygotskian Approach to Child Development.

36. Bodrova E, Leong DJ, Akhutine TV (2011) Vygotsky, Luria and Developmental Neuropsychology.