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Creative thinking skills in the Lebanese schools from secondary physics teachers' perspectives

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Abstract

This paper examines the degree of enhancing creative thinking skills in the physics curriculum in Lebanese secondary schools from the physics teachers' perspectives. It is realistic based study adopted the descriptive quantitative method to collect data by questioner from 141 Lebanese secondary physics teachers from different Lebanese districts. Furthermore, an open-ended interview with many physics teachers was used to triangulate the survey obtained data. Results of both descriptive and inferential statistics indicated that the degree of using creative thinking in the Lebanese secondary schools and curricula is low and insufficient. Moreover, the results showed no statistically significant differences in the level of physics teachers' perceptions about the role of the Lebanese curriculum and secondary schools of enhancing creative thinking skills among physics teachers' gender, qualification and years of experience. Physics teachers must improve their divergent methods of teaching. Furthermore, professional development for teachers and appropriate training for learners on different learning strategies and the integration of well-designed activities in the curricula are a must to improve learners' creative thinking skills.

Keywords: Creative thinking skills, Lebanese physics curriculum, Lebanese secondary schools

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1. Introduction

Creativity has been considered to be one of the most important 21st- century skills. Creativity, or being creative, is the capability to generate, apply or articulate inventive ideas, techniques and perspectives (Ferrari, 2009), often in a collaborative environment. In conjunction with critical thinking and problem-solving skills, to which it closely relates, creativity is a major component of purposeful thinking i.e., a non-chaotic, orderly and organized thought process (Skills, 2018). Creativity consists of flexible, fluent, unique and unordinary thinking in different situations that are important to solve problems and take decisions to achieve success in our life. Being creative is to a large extent connected to the learners' cognitive abilities, including their analytic and evaluative skills (Sternberg, 2006; Shen et al., 2018). Such capacity is about looking at a specific situation and problem from different perspectives to identify challenges, weaknesses, gaps in knowledge, absence of elements then seeking for solutions, estimate and hypothesize or modify hypotheses in relation with trying one of the solutions, and draw conclusions accordingly. It is the imaginative activity shaped so as to produce outcomes that are both original and of value. Thus, we can differentiate creativity as a process of thinking and product that can be judged by its authenticity and benefit.

Beghetto and Kaufman (2013) proclaimed that researchers and educators generally agree that creativity involves the combination of originality and task appropriateness. According to Runco and Jaeger (2012), originality is vital for creativity but it is not enough. Some outputs are original but at the same time they are useless. For the original product to be creative, it should be effective. Effectiveness may take the form of usefulness, fit, appropriateness or value. To sum up, creativity can be defined as synthesizing and redefining previous thoughts and skills included in all fields of life.

The review of the literature concerning creativity shows that almost all learners (children) possess different levels of creative thinking skill (Aljarrah, 2018). However, creative thinking disappears eventually if it is not reinforced and developed by encouraging learners' imagination and concentration and increasing their potentials to think outside the box in a logical way to view the world differently.

Evidently, school culture is vital in supporting or delaying creativity. Practicing creative thinking is important in teaching/learning physics in secondary schools. It supports academic performance and helps uncover learners' various talents. Furthermore, it determines the barriers that limit the extent to which creative thinking is practiced and impacts its development that cannot be neglected for better education. The challenge of educators and curricula designers is to create strategies and learning styles to develop learners' thinking skills, to draw new relationships between experience and knowledge and solve unexpected problems in different real life situations.

The type of activities supported by schools and decided by teacher to introduce the new content and put the learners in problem solving situation associated with appropriate pedagogy contribute to different levels of creative knowledge and skills (Rauth et al., 2010). Furthermore, teacher skills, attitudes, willingness to act as role model, awareness of learners' need, flexible lesson structure and particular types of classroom interaction are important for teaching for creativity (Davies et al., 2014). Hence, teacher should encourage learners to demonstrate divergent thinking and adopt an appropriate creative problem solving (CPS) model where learners are trained to be CPS. They should become familiar by how to determine the problem, collect the necessary information, developing creative ideas about the possible solutions, apply and verify their solutions and reflect on the result to modify if it is necessary.

Research on creativity shows that almost all children possess creative thinking skill at different levels. It is

easier to observe creative skills in young children; however, it disappears eventually as creative thinking is not

reinforced or hindered with comments like "Why don't you do the right?", "Don't be silly!" or "How on earth

do you do that like this?" Creativity can be understood different from its basic meaning as thinking from

different aspects. It is also related with thinking differently from others and creating instead of necessarily

creating out of nothing.

Educational technology tools in this digital era have changed the traditional learning experiences. The implementation of these tools in schools facilitate teachers – learners' interaction and poses a lot of challenges in developing learners' critical and creative thinking (Yehya et al., 2018, 2019) which is beyond the routine information, boring assignments and static curriculum. Yushau & Nannim (2018) claimed that technologies can offer a learning environment under which mathematical skills can be extended beyond the ability to calculate or reproduce problems and enable learners to investigate, analyse and interpret problems at hand. Learners can use an experimental approach to deal with problems, which can lead to assumption, pattern finding, examples and counter examples. In fact, if used effectively, computational aids can help in improving learners' intellectual ability and hence achievement while fostering the required creativity not found in the traditional approach. Physics teachers can benefit from the various educational technology tools in the context of CPS model. Gunawan et al. (2018), in their quasi-experimental study, titled enhancing students' creativity in physics classroom using virtual laboratory, have examined learners' verbal, numerical and figural creativity. They showed within the use of pre-test and post-test control group design the differences regarding the improvement in students' creativity in the participated schools.

Furthermore, the literature review offers many pedagogical strategies and practices that aimed to empower teachers' skills in improving students' creativity. Morphological analysis is one of the pedagogical techniques that may develop learner's creative thinking skills. Learners in this method identify and explore possible solutions to a multi-dimensional complex problem. Morphological analysis encourages learners to analyse the system, or process the problem into its essential dimensions or facets and to place them in a multi-dimensional matrix then to discover new concepts by searching the matrix for creative and useful combinations. If learners can describe a problem situation in terms of its dimensions or facets, the morphological analysis will find original and often innovative solutions.

Furthermore, Synectics is a pedagogical model designed to activate students' creativity and help them to see old ideas in new ways through employing various forms of metaphoric thinking to activate 'generative thinking'. It is classified as a CPS Technique.

Synectics model encourages alternative perceptions of the problem, and uses obvious irrelevant thoughts and images as clues to new ideas. It allows absurd ideas and uses excursions to reproduce the phenomenon of getting new ideas apparently from nowhere (Dhanoa, 2019). According to Nolan (2010), Synectics model has three dimensions: Creative thinking, creative action and creative behaviour. Creative thinking is a procedure to generate new ideas. Creative action is the implementation of these new ideas and creative behaviour is the behavioural skills mandatory to build a supportive atmosphere, which is vital and significant for the two preceding dimensions.

Paltasingh (2008) says in his research article of Synectics that the gain of creativity of those who had been taught using the Synectics model was higher than those who had not. Synectics provides a way to develop the creative thinking ability.

In addition, the Socratic method is a pedagogical technique that may improve learners' creative thinking if it is applied appropriately. Socratic circles promote collaborative and cooperative learning where students learn to build connections between new knowledge and past information (Moeller & Moeller, 2013). Teachers in Socratic technique should not give knowledge directly, but instead asks learners a series questions with the result that the learner comes either to the desired knowledge by answering the questions or to a deeper awareness of the limits of knowledge. They facilitate open-ended collaborative discussions and dialogues between the teacher and the students (Moore & Seeger, 2009; Coffey, 2010; Gilles, Osborn & Johnson, 2017). Socratic questions are open-ended seeking thoughtful responses. Unlike debates, Socratic questions help to further learning by improving the student's reasoning and analytical skills.

Moreover, role-play is an effective technique to animate the teaching and learning atmosphere, arouse the interests of learners and foster creativity. Role-play allows students to be creative and to put themselves in another person's place for a while and gives them an opportunity to practice communicating in different social contexts. In addition, role-plays give learners more responsibility in their learning, encouraging interaction and the chance to evaluate their learning progress (Patel, 2017). Huseby and Bungum (2019) shows how the role-play activity task helps learners to understand the

nature of electrons. One learner acts as a science journalist who is creative in asking questions and interviews the other(s) about the results of the double-slit experiment with electrons to make sense of the experiment and particles as waves. Moreover, focus group interviews turned out that students' reflections on the experiment and challenges in interpreting what the concept of observation involves in quantum physics. Furthermore, Legowo (2016) used the roleplaying learning strategy to create a debate in the nuclear material submission of the Nuclear Power Plant in Environmental Physics Subjects. Active learners in their debate played the role of the government as policy-makers, a group of scientists who were neutral and community groups who refused. Discussions conducted by learners show their abilities to analyse issues from multiple perspectives and reconstruct the available knowledge. This reflects how role-play activities are fundamental for enhancing creative thinking skills.

Both researchers and educators should be aware of the barriers to develop creative thinking skills and the level of creativity in school environments. These include whether educators and policy-makers included creativity as an objective in curricula. Although, the current educational system limits creativity by stigmatizing faults and errors. Sir Ken Robinson (2013) in his TED talk comments that the educational system simply 'kills creativity'. Educators teach students out of their original capacities and consider mistakes as the worst things students can make. If teachers are not aware to give learners the chance to make mistakes, learners are not given the chance to fix their own mistake. Thus, learners can hardly be original. They will never build the confidence to deal with mistakes or failures in the future. Moreover, pushing learners to accept the limited choice offered by instructors to deal with situations minimise their motivation and kills the chance for the development of creative thinking. Furthermore, the evaluation system that makes learners focusing on grading or expected rewards kills learners' imagination and hinders their motivation for investigating new situations and solutions.

Despite the intentions by the Lebanese Ministry of Education and Higher Education (MEHE) in developing learners' creative skills in Lebanese schools (MEHE, 2012), the results of the advanced TIMSS (2011) revealed that Lebanese schools do not enhance creative thinking at a satisfactory and adequate levels (Martin, Mullis, Foy & Stanco, 2012). The Lebanese educational system does not stress the significance of lifelong learning experiences and stimulates sustained economic development. The current Lebanese curricula were not developed since 1997 and the Lebanese physics curriculum does not include creative materials and questions that allow students to deal with new situations in effective ways (Yehya et al., 2018). It does not stress learners' needs, promote the use of modern ICT tools, and try to offer the best teaching and learning strategies to promote student success (Yehya, 2019). The Centre for Educational Research and Development revealed that Lebanese learners' results in the TIMSS (2011) and Pisa (2015) assessments in math and science are very low compared with the results of other countries. Consequently, these results may specify that Lebanese learners did not develop their creative thinking skills and underline the shortfalls in the Lebanese education system in enhancing creativity. Many barriers are limiting the development of creative thinking skills in physics classes. Identifying these barriers encourages the desired improvement in the future of creative thinking in the national education plans for various subjects and may lead to overcoming them in the government's improvement policies.

Accordingly, this current situation leads the researcher to investigate the level of creative thinking skills in the Lebanese educational system and examines how this system put down learners' creativity from the physics teachers' perspective.

2. Aim of the Study

Although creativity is a core life skill that learners should develop from an early age, it appears that we have a low level of creativity in our schools. Educators, curriculum designers and teachers neglect important creative activities. Moreover, in the area of creative thinking in the Lebanese context, there is a lack of the Lebanese studies that examine Lebanese teachers' perspective in general and secondary physics teachers' perspective in particular toward creativity. There are few and not adequate studies that identify the factors that limit the development of learners' creative thinking skills in Lebanese secondary schools and in physics Lebanese classes from Lebanese physics teachers' perspectives.

However, in response to this lack, the current study contributes to the literature concerning creativity in Lebanese physics classes to get an in-depth and clear picture in a natural setting.

The purpose of the current study is to identify and explore Lebanese secondary physics teachers' perspective for the level of learners' creative thinking skills in Lebanese secondary physics classes and that may be common to all disciplines. It also aims to help curricula designers and educators to understand students' difficulties in the creativity process and provide proposals and recommendations to overcome these limitations in the future to reform the Lebanese educational system. Thus, filling the knowledge gap about the factors that limit creative thinking in physics in Lebanese secondary schools and helping educators to achieve their goals in developing learners' creating skills prompt to answer the following research questions:

1- What is the level of creative thinking in Lebanese learning environment?

2- To what level the Lebanese secondary schools improve creative thinking skills in classes from teachers' perspective?

3- To what extent physics secondary curriculum improve creative thinking skills in physics classes from teachers' perspective?

4- Are there statistical significant differences in the total mean score in the level of physics teachers' perceptions about the extent of enhancing creative thinking skills with reference to gender, qualification and years of experience?

3. Methodology

3.1 Research design

The study adopted the quantitative descriptive method as an appropriate research method to answer the study questions and examines the constraining factors to enhance creative thinking skills from secondary physics teachers' perspectives. In this study, structured survey, with different types of questions such as closed-ended and open-ended, has been prepared and used as research instrument to obtain data relevant to the study's objectives and research questions. The survey was reviewed and modified many times by other researchers and pre-tested among a small subset of target respondents to check if it serves to collect appropriate comparable data and to determine its feasibility and usefulness as a research instrument. The measure of central tendency (mean M) and the measure of dispersion (standard deviation [SD]) of the descriptive statistics and the t test of inferential statistics were used to interpret data, generate descriptive information and to lead to important recommendations to reform the educational system.

3.2 Population and sample/study group/participants

Before starting with the description of the population and sampling, it is worth mentioning some background knowledge about the Lebanese education system. Lebanese secondary schools are divided in two main sectors: Public and private sectors. Schools of both sectors are classified, based on the language of instruction in the sciences and languages, into French or English section schools, and some schools have both sections (English and French) in teaching the Lebanese curriculum. Furthermore, many Lebanese secondary schools are classified into girl, boy and co-ed schools. Moreover, the Lebanese curriculum in the secondary education, applied by both official and private secondary schools, offers core physics content for the 10^{th} grade with three 3 physics periods per week to differentiate later in the 11^{th} and 12th grade between scientific, economical and literature sections. In scientific sections, physics subject is dedicated by 5 to 7 periods per week, where in literatures sections and economy and sociology sections, physics subject is dedicated with only 1 period per week (Yehya, 2019).

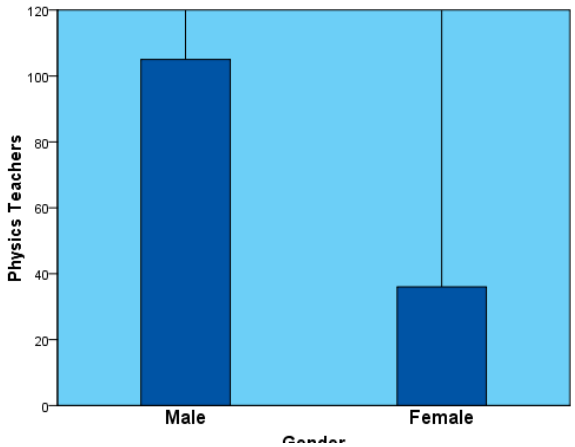

Figure 1. The distribution of the sample according to gender ((74.5% males and25.5% females in the sample)

The population that was considered in this endeavour was all the English Lebanese secondary schools that form a population of 443 schools (126 public schools and 317 private schools) and their physics teachers who teach the scientific sections without gender discrimination. It must be mentioned that the chosen secondary schools for the sampling process are the English section schools because the difference between the languages in determining the level of creative thinking skills, if there is any difference, is beyond the aim of this investigation. Moreover, the concentration on physics teachers for scientific sections is to ensure enough number of periods per week since scientific sections have dedicated more hours per week and that may encourage teachers' initiatives, if any exist, and give better opportunities to enhance creative thinking skills.

In the context of this study, the sample is formed of 141 physics teachers Figure 1, (105 male represents 74.5% of the total sample and 36 female represents 25.5% of the total sample) of 94 secondary schools (51 private schools and 43 official schools), designated by random sampling process from the population of the Lebanese secondary schools that teach physics in English in the academic year 2019/2020 using a table of random numbers.

The level of precision in the existing representative sample for the considered population, using the sample size calculator, indicated that the sample size reflects the target population at 95% confidence level and 9% confidence interval. Moreover, this sample can be considered as a representative sample since the 94 chosen schools represented 22% of the Lebanese secondary schools that instruct physics in English from different socioeconomic backgrounds and geographical locations without any gender discrimination. Moreover, the result of the distribution of the sample according to the gender, experience and qualifications is shown in Table 1.

Table 1. The distribution of the sample

		Frequency	Percent	Valid percent	Cumulative percent
Gender	Male	105	74.5	74.5	74.5
	Female	36	25.5	25.5	100.0
	Total	141	100.0	100.0	
Experience	<10	36	25.5	25.5	25.5
	between 10 and 15	41	29.1	29.1	54.6
	more than 15	64	45.4	45.4	100.0
	Total	141	100.0	100.0	

	BS	122	86.5	86.5	86.5
Qualifications	TD/MS/PHD	19	13.5	13.5	100.0
	Total	141	100.0	100.0	

The results in Table 1 that 74.5% of the teachers are of experience >10 years and only 13.5% are of qualification higher than BS in physics.

3.3 Data collection tools

Two instruments were used in this paper: Open-ended interviews and a survey.

1- The interviews seek to address the aims and objectives of the research and describe the limiting factors of creative thinking skills in the Lebanese educational system from the perspective of physics teachers. Collected data through interviews were vital to answer the research first question and triangulate the survey obtained data. The validity of the interview questions was recognized by rehearsing the interviewing process in detail and piloting the interview schedule on several respondents before beginning the formal study. Interview questions were modified to be understandable and capable of in answering the research questions.
The interview questions are:
I- In your opinion, to what extent creative thinking skills have been used in your institution?
II- In your opinion, to what extent physics teacher are able to enhance creative thinking skills in teaching?
III- In your opinion, what is the best way that can be used to enhance creative thinking skills in your classroom?
IV- What would you suggest to improve the enhancing for creative thinking skills in the future? Clarify your suggestions

2- A survey developed by the researcher, based on the review of literature for previous studies, was used to realize the factors that limit the enhance of creative thinking skills in Lebanese physics classes and investigate the changes needed within schools and education policy makers to better creative skills.
The survey besides its first section about teachers' demographic variables gender, age, teaching experience, level of qualification and workshop attend to enhance creative thinking skills. The survey also contained in its sections different statements the highlight teachers' perspectives concerning the role of school and the applied curriculum in enhancing creative thinking skills in their learning/teaching process. The validity of the survey sections and statements was checked and reviewed by Ph.D. educators and physics instructors and modifications were done based on their instructions and feedback. Furthermore, draft copies from this survey were tested with different teachers to check their clearness and their comments were taken into consideration. Moreover, the reliability of the questions that deal with the limiting factors was measured by Cronbach's alpha. The measure of the internal consistency between survey's questions is 0.686.

3.4 Data collection

The survey was distributed at the beginning of the academic year 2019–2020.

3.5 Data analysis

Data were managed using Statistical Package for the Social Sciences (SPSS v19). The descriptive and inferential statistics were used in summing the data including percentage, frequency, mean, SD, t-test for two-independent samples and one-way ANOVA.

4. Results

The following section reveals separately the results in the context on the research questions of this endeavour to come up finally with a discussion that highlight the role of secondary schools and the adopted curriculum in enhancing creative thinking skills in Lebanese secondary physics classes.

4.1 The results of the first question

Twenty physics teachers responded to interview questions revealing their experiences related to the topic to answer the research first question 'What is the level of creative thinking in Lebanese learning environment?' The interviewees teachers were selected by random sampling who had not participated in the survey study. All interviewees with a degree of freedom and flexibility were asked the same open-ended questions intending to collect the same information. Thematic content analysis was used to analyse the collected data from the interview and to find common patterns across the data set. All the interviewed physics teachers showed interest in enhancing creative thinking skills but they lack the time and appropriate skills. Seventeen out of the twenty physics teachers that were interviewed confirmed that creative thinking skills were rarely used in their teaching practices. They claimed that limited class period time and traditional teaching/learning strategies in schools do not give teachers a margin of freedom to innovate and be proactive, they are obliged to follow old predetermined textbooks that limit the extent of students' creativity. Moreover, physics teachers' answers revealed that the lack of technological resources to be used in classes and the high dependence on textbooks restrict collaborative activities that promote creative thinking among learners in teaching physics communicatively. Only three of the teachers said that they asked learners in groups to be creative in searching solution for daily life problems. They suggested the curriculum development to foster the development for learners' creative skills and teacher training for better enhancing in their classes.

Moreover, physics Lebanese secondary teachers n = 141 responded to the used survey to answer the first question. The survey was designed to collect evidences about physics teachers' level of agreement with the level of creative thinking skills in the learning environment using: Yes/no question about the availability and encouragement to enhance creative thinking in their institutions and to indicate some of these activities that may enhance creativity.

Table 2. Creativity at Lebanese learning environment

Statement		Frequency	Percent	Valid percent	Cumulative percent
Are creative thinking skills available and supported in your learning environment?	No	122	86.5	86.5	86.5
	Yes	19	13.5	13.5	100.0
	Total	141	100.0	100.0	

Unfortunately, schools seem to be not motivated in enhancing creative thinking skills. The collected data shown in Table 2 revealed that 86.5% of physics teachers claimed in the (yes/no) question that there is no support or provision for activities that develop creative thinking skills in their institutions. It seems that many of these schools do not aware the need of creativity, or they do not understand what changes are needed. They are tied to traditional teaching and learning models, satisfied with their tried and tested ways in providing knowledge. Teachers' potentials are directed toward the redundant official exam that directed physics learning to rote memorization and spoon-feeding.

Thus, based on the interview and the results of this part of the survey, the researcher concluded that the level of awareness among creative thinking skills was found to be very low in Lebanese secondary schools.

4.2 The results of the second and third questions

The second question 'To what level the Lebanese secondary schools improve creative thinking skills in classes from teachers' perspective?' and the third question 'To what extent physics secondary curriculum improve creative thinking skills in physics classes from teachers' perspective?' allowed physics teachers to reveal their perspective among the role of the school, learning environments and the physics curriculum in enhancing creative thinking skills.

Physics teachers n = 141 replied on the survey's statements that highlight the level of creativity related to learning environment and curriculum. The survey was formed of two sets of statements with a Likert scale format consisting of four points distributed as following: One = strongly disagree, 2 = disagree, 4 = agree and 5 = strongly agree. There is no choice (three = undecided or neither agree or disagree) to produce a forced choice measure and collect actionable data where no uncaring option was available. Unanswered statements are indicated with three and considered as undecided.

The first set of ten statements shows teachers' agreement on the role of schools and the learning environment on enhancing creative thinking skills and the second set of ten statements reflects teachers' agreement on the role of curriculum and the content in enhancing creative thinking skill in physics courses.

The mean 'M' and the standard deviation 'SD' for each statement were calculated and accordingly the results were arranged in descending order as presented in Table 3.

The analyses of the results were based on the following criteria:

1. The statement of mean <2.5 (M < 2.5) is considered a very low level of creativity
2. The statement of mean 2.5 < M< 3 is considered a low level of creativity
3. The statement of mean 3 < M < 3.5 is considered a moderate level of creativity
4. The statement of mean 3.5 < M < 4 is considered a high level of creativity
5. The statement of mean >4 (M > 4) is considered a very high level of creativity

The results shown in Table 3 revealed that the mean of the teachers' respondents for all the statement of the survey related to the school awareness and support in improving learners' creative skills is either between 2.5 and 3 or <2.5. The total mean of the school enhancement for creative thinking skills is M = 2.4, SD = 0.80. These results highlight the very low level of teachers' agreement with the role of the Lebanese secondary schools in enhancing and improving learners' creative thinking skills. From the physics teachers' perspectives, schools did not insert enough potentials to encourage creative practices (statement 6: M = 2.21, SD = 1.08). The adopted class management in school is not effective in improving creative thinking among students (statement 10: M = 2.55, SD = 1.12). The large number of learners in each class decrease teachers' ability to deal with students individually. Besides, results show that schools have low awareness concerning the creative teaching strategies and the importance of creative learning environment (statement 7: M = 2.55, SD = 1.1). Physics teachers did not hold effective training workshops on helping learners have more practice in using creative thinking. Schools did not give enough attention to the appropriate resources (statement 9: M = 2.5, SD = 1.1) that may facilitate creative skills and to the scientific competitions and creative projects (statement 2: M = 2.55, SD = 1.1). Schools still tied to old limited content (statement 5: M = 2.21, SD = 0.9) and schools limited teachers' freedom to adopt their learning strategies and teach using creative idea (statement 4: M = 2.5, SD = 1.1). It appears clearly that physics classes are focused to finish textbook and support the official exams since creative assignment (statement 3: M = 2.55, SD = 1.12) and creative idea (statement 8: M = 2.55, SD = 1.124) are not supported in the schools' visions as teachers mentioned. Furthermore, teachers revealed the low level of encouraging learning model and learning strategies (Statement 1: M = 2.5, SD = 1.1). Thus, physics teachers believe that Lebanese secondary schools visions do not enhance creative thinking skills despite the importance of creativity as a skill for life in 21st century.

Table 3. Mean and SD for teachers' perspective for the role of school in enhancing creativity

Statements	N	Mean	SD

10-Class management adopted in school improves creative thinking among students	141	2.55	1.124
8-Physics teachers are welcomed to teach creative idea	141	2.55	1.124
7-School is aware about creative teaching strategy and creative learning environment	141	2.55	1.124
3-School encourage creative assignments	141	2.55	1.124
2- School encourage scientific competitions and creative projects	141	2.55	1.124
9-School provides appropriate technology resources that enhance creative thinking	141	2.50	1.100
1-School encourage everything new (models and learning strategies)	141	2.50	1.100
4-Teachers are free to choose content and standardized exams	141	2.49	1.073
5-The content is appropriate and teachers are free to adopt their learning strategies and models	141	2.21	.991
6-Creative practices in school are encouraged	141	2.21	1.086
Total mean		**2.46**	**0.82**

Likewise, the results shown in Table 4 revealed that the total mean of the level of teachers' agreement on the role of physics curriculum in enhancing learners' creative thinking skills in physics classes is low (M = 2.66, SD = 0.80). The mean of the teachers' respondents of all statements that are related to the level of teacher agreement with the role of curriculum in improving learners' creativity is either between 2.5 and 3 or <2.5 except that of the statement 16 of the survey 'Physics curricula are concentrated on theory rather than practical applications'. This result shows the highest level of teachers' agreement was identified for the concentration of the Lebanese physics curriculum on theory and not on practical applications (statement 16) (M = 4.2, SD = 0.83). This is aligned with the low mean of the statement 15 'Curricula concentrate on high order thinking skills questions' (M = 2.23, SD = 1.0). The curricula that are overloaded with concept could not offer time for learners and teachers to practice activities that may improve learns' cognitive skills. In addition, this result is completely aligned with the low mean for teachers' respondents for the statements 12, 13, 17 and 18 of the survey (M = 2.55 SD = 1.12). These results proved that Lebanese physics curriculum is shortened in improving learners' creative thinking skills. Lebanese physics curriculum, as mentioned by teachers, motivates learners to memorize rather than being creative. Moreover, physics teachers believe that the Lebanese physics curriculum did not support the recent learning strategies that are vital in enhancing creative thinking skills. Lebanese physics curriculum lack the creative outputs and lose the chance to develop learners' creativity in answering and dealing with the new authentic situations. According to the physics teachers' perspectives, the available exercises in the Lebanese physics curriculum neglect or ignore creative activities which challenge the students' abilities and deals with real life situations. Physics textbooks lack the effective questions and problems that really enhance learners' thinking skills and create a balance in learners' cognitive skills such as creative thinking skills and critical thinking skills. Learners in physics classes and exams give predetermined answers to certain expected questions. Accordingly, these results highlight the low level of the Lebanese curriculum in enhancing and improving learning strategies and developing learners' creative thinking skills from teachers' perspective.

Table 4. Mean and SD for physics teachers' perspectives for the role of curriculum in enhancing creative thinking skills

Statements	Descriptive statistics n	Mean	SD
16-Physics curricula are concentrated on theory rather than practical applications.	141	4.20	0.830
20-Physics curricula encourage learners to develop their high order thinking skills.	141	2.55	1.124

18-Physics curricula motivate students to think rather than to memorize.	141	2.55	1.124
17-Physics curricula facilitate student-centred learning process.	141	2.55	1.124
13-Physics curricula contents meet the students' real life situations	141	2.55	1.124
12-Physics curricula contents are in line with creative thinking skills	141	2.55	1.124
19-Physics curricula concentrate on real life situations.	141	2.50	1.100
11-Physics curricula objectives have creative outputs	141	2.50	1.100
14-Physics curricula are rich in creative activities which challenge the students' abilities.	141	2.49	1.073
15-Curricula concentrate on high order thinking skills questions.	141	2.23	1.003
Total Mean		2.66	0.80

4.3 The results of the fourth question

The results of the fourth question 'Are there statistical significant differences in the mean (t-test, p = 0.05) in the level of physics teachers' perceptions about the extent of enhancing creative thinking skills with reference to gender, qualification and years of experience?' are shown below.

4.3.1 Significant mean difference with reference to gender

The mean M and the SD for physics teachers' agreement to extent that schools and curriculum can enhance creative thinking skills among the gender of participants are presented in Table 5:

Table 5. The grand mean and SD for teachers agreement with the level of enhancing creativity by schools and curriculum according to gender

Group Statistics					
	Gender	**n**	**Mean**	**SD**	**SEM**
Grand mean	Male	105	2.3257	0.80288	0.07835
school	Female	36	2.8694	0.78333	0.13056
Grand mean	Male	105	2.5314	0.79231	0.07732
Curriculum	Female	36	3.0556	0.72602	0.12100

The independent t-test (Table 6) showed that there is no significant difference in the mean at the 5% level in female agreement toward the enhancing of creative thinking skills compared to that of the male agreement (139) = 3.5, p > 0.05 in a 95% confidence interval. Thus, there is no significant difference in the agreement toward the role of schools and curriculum in enhancing creative thinking skills contributed to teachers' gender.

Table 6. t-test to examine the mean difference in mean between males and female in the role of school and curriculum in enhancing curriculum

Independent samples test		
	Levene's test for equality of variances	t-test for equality of means

		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Standard error difference	95% Confidence interval of the difference	
									Lower	Upper
Grand mean 1	Equal variances assumed	0.838	0.362	−3.528	139	0.01	−0.54373	0.15412	−0.84846	−0.23900
	Equal variances not assumed			−3.571	62.045	0.01	−0.54373	0.15226	−0.84810	−0.23937
Grand mean 2	Equal variances assumed	0.321	0.572	−3.496	139	0.01	−0.52413	0.14990	−0.82051	−0.22774
	Equal variances not assumed			−3.650	65.730	0.01	−0.52413	0.14360	−0.81085	−0.23740

4.3.2 Significant mean difference with reference to teachers' qualifications

The mean M and the SD for physics teachers' agreement to extent that schools and curriculum can enhance creative thinking skills among the qualification of participants are presented in Table 7:

Table 7. The grand mean and SD for teachers agreement with the level of enhancing creativity by schools and curriculum according to participants' qualifications

Group statistics

	Qualifications	**n**	**Mean**	**SD**	**SEM**
Grand mean 1	BS	122	2.4393	0.82638	0.07482
	TD/MS/PHD	19	2.6263	0.85754	0.19673
Grand mean 2	BS	122	2.6566	0.79741	0.07219
	TD/MS/PHD	19	2.7211	0.88480	0.20299

The independent t-test (Table 8) showed that there is no significant difference in the mean at the 5% level in BS teachers' agreement toward the enhancing of creative thinking skills compared to that of the TD/MS/PhD teachers' agreement $t(139) = 3.52$, $p > 0.05$ in a 95% confidence interval. Thus, there is no difference in the agreement toward the role of schools and curriculum in enhancing creative thinking skills contributed to teachers' qualifications.

Table 8. t-test to examine the mean difference in mean in the role of schools and curriculum in enhancing creativity contributed to teachers' qualifications

		Independent samples test								
		Levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Standard error difference	95% Confidence interval of the difference	
									Lower	Upper
Grand mean 1	Equal variances assumed	0.045	0.833	−0.913	139	0.363	−0.18697	0.20482	−0.59195	0.21800
	Equal variances not assumed			−0.888	23.510	0.383	−0.18697	0.21048	−0.62186	0.24792
Grand mean 2	Equal variances assumed	0.277	0.600	−0.323	139	0.747	−0.06450	0.19959	−0.45912	0.33013
	Equal variances not assumed			−0.299	22.788	0.767	−0.06450	0.21544	−0.51040	0.38141

4.3.3 Significant mean difference with reference to teachers' qualifications

The descriptive Table 9 (shown below) provides useful descriptive statistics, including the mean M, SD and 95% confidence intervals for physics teachers' agreement to extent that schools and curriculum can enhance creative thinking skills among the participants' experiences for each separate experience groups (<10, between 10 and 15, and more than 15), as well as the total mean for all groups.

Table 9. The grands mean and SD for teachers agreement with the level of enhancing creativity by schools and curriculum according to teachers' experiences

		n	Mean	SD	SE	95% Confidence interval for mean	
						Lower bound	Upper bound
Grand mean 1	<10	36	2.7778	0.81490	0.13582	2.5021	3.0535
	between 10 and 15	41	2.2049	0.72282	0.11289	1.9767	2.4330
	more than 15	64	2.4547	0.85448	0.10681	2.2412	2.6681
	Total	141	2.4645	0.82999	0.06990	2.3263	2.6027
Grand mean 2	< 10	36	2.9500	0.80835	0.13472	2.6765	3.2235
	between 10 and 15	41	2.4122	0.69108	0.10793	2.1941	2.6303
	more than 15	64	2.6672	0.83172	0.10397	2.4594	2.8749
	Total	141	2.6652	0.80667	0.06793	2.5309	2.7996

Moreover, a one-way analysis of variance (ANOVA) was calculated. The one-way ANOVA ('analysis of variance') shown in Table 10 compares the means across the three independent groups (experiences

<10; between 10 and 15; more than 15) to determine whether there is a statistical evidence that the associated means are significantly different.

Table 10. One-way ANOVA to examine the statistical difference among the means of the three groups

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Grand mean 1	Between groups	6.303	2	3.151	4.825	0.009
	Within groups	90.140	138	0.653		
	Total	96.443	140			
Grand mean 2	Between groups	5.545	2	2.772	4.472	0.013
	Within groups	85.555	138	.620		
	Total	91.100	140			

The one-way ANOVA showed that there is no significant difference in the means at the 5%. Level in teachers' agreement about the level of secondary schools $F(2,138) = 4.82$, $p = 0.09$ ($p > 0.05$) enhancing creative thinking skills between any of the groups and in teachers' agreement about the level of Lebanese physics curriculum in enhancing creative thinking skills between any of the groups $F(2,138) = 2.77$, $p = 0.13$ ($p > 0.05$) in a 95% confidence interval.

Finally, we can conclude that that there are no statistically significant differences ($p < 0.05$) between the teachers' agreements about the level that schools and curriculum enhancing for creative thinking skills in physics classes contributed to teachers' gender, qualification and experience.

They all agreed regardless their experience, gender and qualifications that secondary schools do not encourage creative skills in the teaching and learning process. They also agreed strongly that the curricula lack curricular objectives and strategies for developing creative thinking among the learners and verify their needs in the learning process.

5. Discussion and Conclusion

Teachers are significant drivers whose roles are crucial in enhancing creative thinking skills in the classrooms (Yehya, 2019). Teachers confirmed that Lebanese secondary schools with their big class size do not inspire recent strategies and resources and limit the enhancing creative thinking. This can be attributed to the administrative visions that evaluate teachers' potentials and abilities referring to learners' grades in official exams. Learners are not supported to think out of the box in solving different situations. Teachers main concentrations are on covering the course material and prepare learners to the final official exams. Hence, they do not have the intension and the sufficient time to apply learning strategies and problem solving skills that may enhance creative thinking skills. Consequently, teaching was transformed to delivering the overloaded content to learners in a limited time interval and lacks the real life activities that really challenge students' high thinking skills regardless their key role as a key construct for 21st century education in this fourth industrial revolution.

Educational system should be aware about the importance of creativity in developing learners' high order thinking skills. Successful organizations are those that extend learners' innovative capability (Schiuma, 2017). Schools should situate and embody creative thinking, explain the intentionality and motivation for creative actions, overcoming perceptual differences and changing practices and routines (Thompson, 2018). They should offer well selected real life problems in their learning processes that motivate learners' creativity and fulfil the gap in the physics curriculum.

Physics curriculum should develop learners' abilities in generating and evaluating knowledge, clarifying concepts and ideas, seeking possible alternatives, considering different factors and solving problems. Thus, critical and creative thinking should be implemented to curriculum by means of activities that require learners to think broadly and deeply using skills, behaviours and dispositions such as reason, logic, resourcefulness, imagination and innovation in learning at school and in their real life in

their society. Consequently, special attention should be directed to the selection for the physics content. The well-chosen content plays a key role in attracting learners' attention and motivating them to think more creatively in their learning.

This study found no significant difference in teachers' perspectives concerning the level of schools and curriculum in enhancing creative thinking skill in physics classes due to physics teachers' gender, years of experience and qualifications. These results, from one side, can be attributed to Lebanese educational vision that lacks the concentration on the creativity as an important factor in Lebanese learners' profile. Moreover, these findings, from the second side, can be attributed to the limitation in physics curriculum that limits teachers' role in enhancing creativity regardless their qualifications and experiences. Moreover, the lack in professional development on teaching/learning strategies that encourage learners' motivations and train teachers to think about thinking strategies and to manage activities of enhancing creativity can also be attributed as main element for the non-significance difference in teachers' perspectives despite their gender experiences and qualification.

The study highlighted the low level of the creative thinking skills in Lebanese secondary schools and in the physics curriculum from the physics teachers' perspective. Furthermore, the study highlighted the lack of effective training to find out methods for enhancing creativity in Lebanese physics classes. The findings of the study have implications for educators and policy-makers. Thus, the ministry of educations, policy-makers, schools, teachers and community should cooperate, each in his field to provide a conducive environment for teachers to experience success enhancing creative skills. Policy-makers and the ministry of education are responsible for the improvement in the current education system and the development of the physics curriculum. They should look into teachers' needs in enhancing creative thinking and offer appropriate resources. Policy-makers and the ministry of education should train teachers to gain competence and confidence in using activities for enhancing creative thinking skills in teaching and learning processes. Schools should emphasize the worth of creativity in their visions. Teachers must improve their divergent methods of teaching. They must design their teaching models to increase learners' motivation and participation in the classroom. They must foster creativity by enrich the physic curriculum with appropriate imaginative activities and creative assignments that develop learns' creativity in solving real life situations.

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