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Knowledge level of Next Generation Science Standards (NGSS) among the preparatory stage science teachers in Gaza's UNRWA schools and their attitudes towards it.

[1-] Hala Hamid Abu Amra

[1.] *Department of Curriculum and Teaching Methods / Faculty of Education / College of Education / Al-Aqsa University, Gaza-Palestine.*

Abstract

Background

The Next Generation Science Standards (NGSS), are standards that integrate between engineering and science education by including design as the central element in science education and building experiments and models, which helps build a new generation capable of discovery and deep understanding and has the cognitive ability and practices necessary to face different life situations, which require them to act appropriate to the situation and take decisions related to setting the desired goals. It is very necessary to focus on the professional development of science teachers on an ongoing basis and to monitor global and modern trends in scientific education and to benefit from them in teacher training programs. The teacher is the most important factor in implementing the Next Generation Science Standards by possessing applied knowledge in light of these standards. Therefore, this study aimed to investigate the level of practical knowledge of the middle school science teachers in Gaza's UNRWA schools, their attitudes towards them and their desire for development.

Materials and Methods:

To achieve the objectives of the study, an (NGSS) Knowledge test was designed, this test is used to give an indication of the practical knowledge and cultural awareness of NGSS standards. The researcher also built a second study tool whose function is to measure the level of science teachers 'attitudes towards using the Next Generation Science Standards (NGSS) in planning and implementing lessons for the preparatory school in the Gaza Strip, and the study adopted the descriptive approach and this is consistent with the nature of the study and its objectives. The descriptive research includes collecting data in order to examine theories or answer questions concerned with the current situation of the groups studied, and among the common types in such studies those related to attitudes or opinions towards different issues. The original study population consisted of middle school science teachers in UNRWA schools of (176) teachers, and the study sample was (79) teachers. The study tools were applied to the study sample

Results:

The study showed that with regard to the percentage of knowledge level of Next Generation Science Standards (NGSS) among middle school science teachers in Gaza's UNRWA schools was 43.13%, which is a low percentage of course, but it also found that the level of trend towards (NGSS) among the teachers was 72.1%.

Conclusion:

It appears to us that there is a correlation between the level of knowledge of the Next Generation Science Standards (NGSS) for the middle school science teachers and their attitudes towards them, and these results show that a science teacher has a desire to develop his knowledge with all that is new

Key Word: *Next Generation Science Standards (NGSS)- practical Knowledge level- middle school science teachers- United Nations Relief and Work Agency (UNRWA)- trend towards NGSS.*

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I. Introduction

The Next Generation Science Standards (NGSS) are new standards for science education set for today's students and for tomorrow's teachers, and they are rich in content and practice. This new trend has been concerned with setting a wide range of expectations for students in science, and this was the overarching goal of the education framework as a guarantee that all students at the end of high school have sufficient knowledge in science and engineering to participate in public discussions about related societal issues, and to also become able to face the scientific and technological problems that they would face in their daily lives, and also have the ability to continue learning and seeking knowledge outside of school, in addition to possessing the necessary expertise to enter the professions of their choice including careers in the field of science, engineering and

technology, as a number of countries seek to adopt this framework in common standards for Mathematics, English and Arts. For this reason, there was a need to collect foundational information about the Next Generation Science Standards in our Palestinian schools, to know the extent of teachers 'awareness of these standards, especially science teachers, as the current research investigates the nature and culture of NGSS standards that are concerned with scientific and technological practices in Palestinian schools, and to what extent have we been able to prepare our current teachers to possess the minimum level of awareness of these standards. The research provides decision-makers with a list of these standards that must be taken into consideration in designing science teacher education programs in order to establish a comprehensive change in our curricula in science in the coming years, to introduce and adopt these Standards in it.

II. Material and Methods

This descriptive study was conducted on middle school science teachers in Gaza's UNRWA schools in the first semester of the academic year 2019-2020, on a sample of (79) teachers in three educational regions: North Gaza - West Gaza – Rafah.

Study Design: A study based on the descriptive method and data collection.

Study Location: The study was implemented in the UNRWA middle schools, in three educational districts in North Gaza, West Gaza and Rafah..

Study Duration: The first semester of the academic year 2019-2020

Sample Size: The study sample consisted of 79 female Science teachers.

Sample Size Calculation: The sample was randomly selected, as the original community included 176 teachers, and the size of the • The study sample was taken from middle school science teachers in Gaza's UNRWA schools according to the following random distribution: Rafah area (25), Gaza area (27), North region (27).

Inclusion criteria:

1- A teacher during the service.
2- Middle school science teacher.
3- Both sexes.
4- Teachers working in UNRWA schools

Exclusion criteria

- Teachers during field training.
- Non-science teachers.

Procedure methodology:

The researcher followed the descriptive approach and this is commensurate with the nature of the study in order to examine theories or answer questions. Among the common types in such studies are those related to trends or opinions towards different issues, where the study community consists of science teachers for the preparatory stage in Gaza's UNRWA schools, in the first semester of the academic year (2019-2020), and a study tools have been applied to the study sample, namely: a test that measures the level of practical knowledge in the Next Generation Science Standards (NGSS), and this test is used to give an indication of cognitive and cultural awareness of (NGSS) standards, and a test that measures the trend towards using Next Generation Science Standards (NGSS) where this test represents the emotional aspects of Next Generation Science Standards Awareness.

In order to prepare the test, the dimensions of (NGSS) were defined by reviewing the educational studies and research specialized in the field of (NGSS), and interviews were conducted with a number of specialized professors, and then determining the topics to be addressed in the study and their various dimensions represented in the related applications with the dimensions of the (NGSS) standards, then the test items were constructed and formulated so as to take into account the following matters: scientific and linguistic accuracy, free from ambiguity, representative of the content, appropriate to all student's levels and with clear instructions.

In light of the foregoing, the test was prepared in its initial form so that it included 25 paragraphs, each paragraph had four alternatives, only one of which was correct, and after writing the test paragraphs, they were presented in their initial form to a group of specialized judges to confirm the validity of the test content. The judges added their amendments to some paragraphs, in terms of wording and amending some alternatives to make them more suitable for the topic, and the final image of the test consisted of 27 items distributed on the main dimensions of the Next Generation Science Standards, which are: Disciplinary Core Ideas, Crosscutting Concepts and Scientific and Engineering practices. It was applied to an exploratory sample to calculate the validity of the internal consistency, by calculating the Pearson correlation coefficient between the scores of each paragraph of the dimension with the total degree of the dimension, and the correlation coefficient was statistically significant in each paragraph, as well as the correlation coefficients between the degree of each dimension of the test 'dimensions, in the total score of the test. The correlation values ranged between (0.393-0.568), then the test was applied to the students of the pilot sample and the results of the students 'answers to the

test questions were analyzed with the aim of identifying the difficulty factor and the coefficient of discrimination for each paragraph of the test. The questions whose distinction coefficient was less than 20 and more than 80 were adopted, and accordingly, no paragraph was deleted and the paragraphs were of acceptable distinction. The ease coefficients ranged between (18.52% -59.26%) with an overall average of (39%), and the test reliability percentage reached (85.71%), which indicates that the test has a good degree of stability that suits the requirements of the study.

The researcher also prepared a second tool for the test, which is a scale that measures the trend towards (NGSS), and its aim is to measure the level of the trend of science teachers towards using (NGSS) in planning and implementing lessons for the preparatory stage in the Gaza Strip, the validity of the tool was verified by an experienced group of arbitrators. Some paragraphs were excluded and some were amended, and the validity of the internal consistency of the questionnaire was calculated, as the questionnaire (the scale) was applied to a survey sample of 25 middle school science teachers - who are from the study community - to measure the validity of internal consistency by calculating the Pearson correlation coefficient, and all the paragraphs were statistical function and the stability of the paragraphs reached (95.51%), which is a good stability rate, and after making sure of the validity and stability of the trend scale, the questionnaire was applied in its final form to a sample of science teachers who are working in UNRWA schools.

Statistical Analysis.

1- The percentage of knowledge level of Next Generation Science Standards (NGSS) among middle school science teachers in Gaza's UNRWA schools is 43.13%, which is a low percentage, below the required and desired.

2- There are no statistically significant differences at the level of significance ($\alpha \leq 0.05$) in the knowledge level of (NGSS) among UNRWA's middle school science teachers due to the educational region variable in the test in general.

3- It was found that the level of trend towards Next Generation Science Standards (NGSS) among middle school science teachers in Gaza's UNRWA schools reached 72.1, and this indicates a desire and inclination to learn more about the NGSS standards.

4- It also appears that there is a correlation between the knowledge level of (NGSS) standards of the teachers, and their attitudes towards them, and these results indicate that the science teacher has a desire to develop their knowledge with all that is new. Among the recommendations of the study was the necessity of including NGSS standards in the in-service science teacher courses, and providing specialists and supervisors with them**.**

III. Result

To answer the first question, which states: "What is the knowledge level of the Next Generation Science Standards (NGSS) for the middle school science teachers in Gaza's UNRWA schools?" And to verify the first hypothesis which states: "The knowledge level of the Next Generation Science Standards (NGSS) of these teachers is not less than 75%", The researcher used averages and percentages, and the results were within the following table:

Table (1)

Filed	paragraphs	Paragraphs no.	Sample no.	Correct answers	Average	Sd.	Perc. %
S test 1	1\2\3\4\5\25	6	79	39.7	0.502	0.506	%50.2
S test 2	6\7\8\9\10	5	79	37.2	0.478	0.452	%47.8
S test 3	11\12\13 14\15\16 17\18\19 20\21\27	12	79	29.5	0.373	0.461	%37.34
S test 4	22\23\24\26	4	79	35.50	0.45	0.48	%44.95
S test.		27	79	34.074	0.431	0.471	%43.130

From the previous table it was found that the percentage of the level of knowledge of (NGSS) among middle school science teachers in Gaza's UNRWA schools is 43.13%, which is a low percentage and below the required and desired, and this contradicts the assumption that: "The level of knowledge of (NGSS) among science teachers for the preparatory stage in Gaza's UNRWA schools is no less than 75% ". Even in the four NGSS dimensions, no dimension has reached the desired percentage which is equal to 75% or more, so that the 27 test items did not obtain this percentage that was determined as a criterion for judging the acquisition of a level of knowledge in the (NGSS) standard, and only one paragraph of the entire test got a high percentage of more than 70%, which is the ninth paragraph of the dimension of Scientific and Engineering practices, with a percentage of 72.2%.

These results can be explained by the lack of awareness of the teachers from the study sample, of knowledge of the Next Generation Science Standards (NGSS), or the educational specialists did not address them because they were not aware of them as well, and they were not even given a brief about it in the educational courses, just as the university curricula for science teaching methods did not also mention it. And even if some of the lecturers shed some light on it, it would be on a small scale, and this is proven by the results of the test for middle school science teachers.

To answer the second question, which states: "Are there statistically significant differences at the level of significance ($\alpha \leq 0.05$) in the level of knowledge of Next Generation Science Standards (NGSS) among science teachers for the preparatory stage in Gaza's UNRWA schools due to the variable of the educational region?" And to verify the second hypothesis, which states: "There are no statistically significant differences at the level of ($\alpha \leq 0.05$) in the level of knowledge of (NGSS) among science teachers for the preparatory stage in Gaza's UNRWA schools that are attributable to the variable of the educational district, the One Way Anova variance test was used, and the results were as can be seen from the following table:

Table (2)

Filed	Variances	Sum of square	df	Mean Square	F	Sig
S.Test.1	Between Groups	.813	2	.406	.175	.840
	Within Groups	176.175	76	2.318		
	Total	176.987	78			
S.Test.2	Between Groups	3.243	2	1.622	1.037	.359
	Within Groups	118.833	76	1.564		
	Total	122.076	78			
S.Test.3	Between Groups	39.244	2	19.622	7.153	.001
	Within Groups	208.477	76	2.743		
	Total	247.722	78			
S.Test.4	Between Groups	1.157	2	.578	.691	.504
	Within Groups	63.603	76	.837		
	Total	64.759	78			
S.Test	Between Groups	53.086	2	26.543	1.741	.182
	Within Groups	1158.990	76	15.250		
	Total	1212.076	78			

Filed	Variances	Sum of square	df	Mean Square	F	Sig. Level	Sig.
S.Test.1	Between Groups	.813	2	.406	.175	0.840	non
	Within Groups	176.175	76	2.318			
	Total	176.987	78				
S.Test.2	Between Groups	3.243	2	1.622	1.037	0.359	non
	Within Groups	118.833	76	1.564			
	Total	122.076	78				
S.Test.3	Between Groups	39.244	2	19.622	7.153	**0.001	Exist
	Within Groups	208.477	76	2.743			
	Total	247.722	78				
S.Test.4	Between Groups	1.157	2	.578	.691	0.504	non
	Within Groups	63.603	76	.837			
	Total	64.759	78				
S.Test	Between Groups	53.086	2	26.543	1.741	0.182	non
	Within Groups	1158.990	76	15.250			
	Total	1212.076	78				

From the previous table, it is evident that there are no statistically significant differences at the level of significance ($\alpha \leq 0.05$) in the level of knowledge of (NGSS) for science teachers for the preparatory stage in Gaza's UNRWA schools due to the educational region variable in the test in general, and in all its fields, except for the third dimension, which is the Crosscutting Concepts. And this is consistent with the hypothesis of the question, and this may be due to the similarity of circumstances in courses, levels and curricula. But for the Crosscutting concepts dimension, there was a difference, and in order to find out in which educational district this difference was found, the Tukey test was performed and the results were as follows:

Dependent Variable		(I) Area	(J) Area	Mean Difference (I-J)	Std. Error	Sig.
			Gaza city	-.03852-	.34706	1.000
S.Test.3	Tukey HSD	North	Gaza city	1.00000	.45077	.074
			Rafah	-.72741-	.45970	.259
		Gaza city	North	-1.00000-	.45077	.074
			Rafah	-1.72741-*	.45970	.001

		Rafah	North	.72741	.45970	.259
			Gaza city	1.72741*	.45970	.001

			Subset for alpha = 0.05	
	Area	N	1	2
Tukey HSD[a,b]	Gaza city	27	3.5926	
	North	27	4.5926	4.5926
	Rafah	25		5.3200
	Sig.		.079	.255

From the previous table of the Toki test, it is evident that there is a difference between the Rafah and Gaza regions, but there is no difference between the northern region and the Rafah or Gaza areas, and the difference in the level of knowledge of (NGSS) among middle school science teachers stage in Gaza's UNRWA schools is due to the educational region variable between the Rafah and Gaza regions, in favor of the Rafah region, and when looking at the arithmetic mean, we find that the average of the Rafah area is greater than the Gaza area (3.5926 <5.3200) at the level of significance less than 0.01, and the reason for this lies in the dimension of crosscutting concepts, for example the science supervisor in the Rafah area may had dealt with the topic, even briefly as a reference from him in a teacher training course or the like, while the science supervisor in the Gaza region did not address this topic or its concepts.

To answer the third question, which states that: "What is the level of trend towards (NGSS) among middle school science teachers in Gaza's UNRWA schools?" And to verify the third hypothesis which states: "The level of trend towards (NGSS) for middle school science teachers in UNRWA schools in Gaza is not less than 75%", The researcher created a scale that measures the level of trend towards (NGSS) in a form of a questionnaires.

The 79 questionnaires were unloaded on the Statistical Package for Social Sciences (SPSS) program, so that the results of the general average towards positivity in the scale are according to the following table:

Table (4): the level of trend towards the Next Generation Science Standards (NGSS) among middle school science teachers in Gaza's UNRWA schools

	Mean max. value	Mean average	Standard deviation	Perc. %	Number
Trend towards NGSS	5	3.61	0.46	72.1%	30

The previous table shows that the level of trend towards the Next Generation Science Standards (NGSS) among middle school science teachers in Gaza's UNRWA schools reached 72.1%, And this is a good percentage in general despite the fact that the percentage of the practical knowledge of NGSS among middle school science teachers in Gaza's UNRWA schools is 43.13%. This is considered a positive point for the science teachers, which indicates their desire and tendency to learn more about (NGSS).

To answer the fourth question, which states: "Is there a correlation between the level of knowledge of (NGSS) among middle school science teachers in Gaza's UNRWA schools, and their attitudes towards it?" And to verify the fourth hypothesis, which states: "There is no correlation between the level of knowledge of (NGSS) among the middle school science teachers in UNRWA schools in Gaza and their attitudes towards it". The researcher used the Pearson correlation coefficient, and the results are shown in the following table:

Table (5): The relationship between the level of knowledge of (NGSS) among science teachers for the preparatory stage in Gaza's UNRWA schools, and their attitudes towards it, for a sample of 79 female students.

Field	Correlation coefficient	Sig. level	Sig.
S. Test. 1	0.401	0.000	Sig.
S. Test. 2	0.486	0.000	Sig.
S. Test. 3	0.261	0.020	Sig.
S. Test. 4	0.336	0.002	Sig.
S. Test.	0.503	0.000	Sig.

From the previous table, it is evident that there is a correlation between the level of knowledge of (NGSS) among science teachers for the preparatory stage in Gaza's UNRWA schools, and their attitudes towards it, and this contradicts the third assumption in the absence of a correlation, and this is an indication that

the more knowledge of (NGSS) increases, teachers 'tendencies also increase towards becoming more familiar with these standards. These results show that science teachers have the desire to develop their knowledge of everything new, and that they are completely consistent with the purpose of the study.

IV. Discussion

Most of the specialized professors who have seen the results of the current study have agreed on the necessity of applying the Next Generation Science Standards (NGSS) within the teaching plans for teachers, and including them in the teaching courses in the programs for preparing science teachers to ensure the graduation of teachers who are ready for the next stage of science education. Also, some of the current Palestinian and Arab curricula need deep knowledge enrichment, as the knowledge structure of our curricula is not ready and needs a lot of effort to accommodate these new standards, and this is why most studies recommended the necessity of a complete review of the content of the current curricula (especially in the secondary and university stages) and evaluating and developing them. The researcher also stresses the need to pay attention to programs for preparing science teachers and expand the provision of training programs in various fields of science and technology for all interested people, and emphasize the importance of strengthening the role of universities and other sectors to spread the culture of (NGSS) standards in preparation for the next generation. We still need more development, and it has become imperative that educational initiatives coincide with the financial support and mechanisms that are still absent from our Arab world.

In this context, many European Union countries embarked on developing a new strategy for education in the science standards, as these standards were prepared by the National Research Council (NGSS, 2011). The K-12 framework is based on a rich and growing body of research in the field of teaching and science learning, in order to define the basic knowledge and skills required for the K-12 science and engineering framework, and from this the committee concluded that the K-12 science education framework should focus on a limited number of core ideas, as well as crosscutting concepts, and is designed in a sequential manner so that students can build their knowledge and review their abilities over a number of school years and work to integrate this knowledge into the practices required to engage in scientific research and engineering design. (NGSS.Lead States, 2013).

The researcher points out that the level of information and scientific knowledge for the middle school science teachers in relation to the Next Generation Science Standards (NGSS) is still limited, as it does not exceed 43.13% in its maximum limit, and this is a low level according to experts 'opinion and is not reliable, despite the apparent interest in these standards in the research movement and scientific conferences in Palestine.

The level of the teachers 'sample's attitudes towards these standards is considered acceptable (72%), and the reason for the emergence of such high percentage is due to the teachers' desire to work hard to develop oneself and to be keen to keep pace with developments in the field of education, so through previous results and in the interest of future generations, the researcher recommends the necessity to include both in-service science teachers' courses as well as the curriculum with NGSS standards, and to equip university students specializing in science education with these standards through school curricula and research assignments or reports related to the academic programs they are taking.

V. Conclusion

There is an urgent necessity for education to be accompanied by more interest in following up with the scientific change that has occurred, and to increase the financial support of the development programs concerned with the inclusion of Next Generation Science Standards (NGSS) in teacher education programs, and dealing with these new sciences and emerging them with other scientific subjects in an elaborate, integrative framework

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