Strategies for Preparatory Year Teaching at the University of Hanover-Germany: Computer Science Courses as a Model

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Abstract

The preparatory year plays a major role in the success of higher education in all international universities. To make sure that the preparatory year is being implemented optimally, it is necessary to find out an appropriate solution. It should make students ready to enter universities by bridging the gap between schools and universities at the scientific level. This mechanism must be studied carefully by testing and implementing practically. Also, the relevance and effectiveness of applying such a mechanism in higher education should be analyzed appropriately. Accordingly, developing a general strategic plan during the operation of the preparatory year is the first step for this mechanism. The second step is to adapt and amend this general plan so that it becomes appropriate to apply it to each specialized course in the preparatory year. Based on this mechanism, a new strategy called "Achieving Connectivity" for planning and developing the syllabus of the computer science course has been proposed in this paper. It mainly focuses on the preparatory year, to play the role of linking & connecting between students and the university than the role in mastering students of the curriculum. The proposed mechanism has been experimented by implementing it at the Lower Saxony State Center of Hanover University in Germany (responsible for the operation of the preparatory year). To analyze the performance of the proposed preparatory year strategy, feedback from students is obtained through a questionnaire. The results show that more than 90% of students strongly agreed to the benefit of the different methods followed in the new strategy.

Keywords: Preparatory Year, Curriculum Development and General Teaching Strategy, Adaptation of Teaching Methods, Computer Science Course, Lower Saxony State Center, Hanover University.

1. Introduction

How can teachers deal with challenges in motivating students, starting from those who carry bags filled with machines and are Internet enthusiasts, to become language-learning enthusiasts, and to reach the economically disadvantaged people, or who are between this and that? How can teachers help students to learn, what they do need to know as the world and everything is being changed quickly? The standardized and crucial tests have not answered these questions yet, but the teachers have. This research investigates real-life education in this information age to place students at the center of the teaching and learning process by linking learning objectives with real life scenarios. The research also concentrates on the transmission from the traditional teaching concept to new adaptive learning that allows teachers to motivate students to be independent, imaginative, and responsible learners for life.

Based on the researcher's extrapolation of students' tendencies, attitudes, and their use of computer science in the way he dealt with them, he realized the importance of the difference between the method of teaching computer science as a renewable modern material and teaching other courses of the preparatory year. The researcher is fully convinced with the teachers who stand on this extrapolation and can transform the education, opportunities, and life of their students into a tangible and desirable reality. On the other hand, the researcher believes that the strategy of the transformative approach in teaching will generate high-quality education for students who need to expect instant gratification.

The researcher has adopted theories, practice, and personal experience in teaching students in the preparatory year, to raise a compelling case to prioritize the teacher-student relationship in the productive classroom; because student rapport is important so that to teach students according to their needs of this strategy that is applied in the teaching of computer science, which relied mainly on linking the content of the subject to the target real life functions according to the perspective that teaching cannot be just an effort to complement the content and success in the standardized tests and achieve reasonable annual progress. Despite serving the generation, teaching should focus on helping each student acquire knowledge, skills, and attitudes to lead a satisfying and realistic life in the face of storms of rapid technological change.

2. Role of the Preparatory Year in International Universities

Many Arab and international universities have introduced the idea that students should study their first academic year with the aim of preparing them to facilitate the transition from a school life that relies heavily on indoctrination (the teacher at the school is guided by all forms of student education as well as student activity) to university life that is highly dependent on self-education, searching for information and going deeper into the points explained by the university teacher.

This process of preparation at the first academic year termed as the *preparatory year* by some Arab universities plays an important in making the student evolve from school education to university level. Therefore, universities around the world are interested in this concept and trying various strategies to find the best way to narrow the gap between these two phases of a student's life and to develop the educational process at the universities.

In this context, special buildings have been established to teach the preparatory year in many universities, for example, the universities in Saudi Arabia and Germany. Some universities have also commissioned private companies to teach preparatory year subjects, while others have relied on their faculties or companies to supervise laboratories or to supply the necessary techniques to operate the preparatory year.

Preparatory Year in Saudi Universities

The desire has evolved significantly to improve the outcomes of the preparatory year at the universities in Saudi Arabia as conferences were held for this purpose. The first national conference was held in the year 2015 [1] which had several axes focused on the concept of the preparatory year and its origin, organizational structures, strategic policies and the mechanism of operation, plans and programs used in it, and the evaluation of its experience, future, and quality study.

The objectives of the conference were to provide the importance of the preparatory year to the community and activate the scientific aspect in its operation, review the most important local and international experiences in its operation, identify the experiences of Saudi

universities in the partnership of the private sector and the extent of its contribution to the operation of the preparatory year, in addition to identifying the modalities, mechanisms, and challenges of their operation, studying the unification of their curricula and courses in the Kingdom, and developing a plan for their operation in the framework of continuous development of the educational process.

The theme of the second national conference in the year 2017 [2] was about the integration of preparatory programs with general education so that students could be prepared for university life and help them to enter the disciplines they desire as it fits their potential and ability. On the other hand, the preparatory programs should be integrated with the post-university specialized education to cope with the needs of the labor market that helps achieve the Saudi National Vision 2030.

This conference had several axes focused on integrating the roles of the preparatory years with both the public education and the university system, in addition to the axes studying the preparatory years with the requirements of the labor market and with the Saudi National Vision 2030.

The objectives of the conference were to discuss the relationship between the preparatory year programs in universities with both general education and scientific departments within universities, to study the impact of these programs in achieving the requirements of the labor market and achieving the outputs of Saudi universities, and to review the most important local and international experiences in this regard.

Preparatory Year in German Universities

The German government has shown a great interest in the preparatory year for several reasons in which the most important one is the fact that German universities receive a large number of foreign students whose secondary certificates are not recognized (acknowledged) by German universities or that their general secondary grades do not qualify them to enter German universities. Therefore, they have to successfully pass the preparatory year in order to be eligible to enroll at the universities. Thus, each state of the Federal Republic of Germany has established special buildings for administration and preparatory year curriculum teaching. The most prominent of these is the Lower Saxony Preparatory Year Center at the University of Hanover in Germany [3].

The Lower Saxony Preparatory Year Center is a unified center for preparatory year students, that mainly serves students of all universities in Lower Saxony state such as the University of Hanover, Göttingen, Braunschweig, and Clausthal among others. This center aims to raise the level of students and help them in educational attainment to ensure a smooth transition from school to university education.

The author of this article is responsible for developing and teaching the curriculum of the computer science course at this center for several years (from 2009 to 2016) and has worked to devise a new general teaching strategy that does not exist previously (according to his knowledge so far) as a first step in the planning and development of the curriculum used in operation of the preparatory year, besides, to adapt it to suit the course of computer science as a second step so that to improve the level of students.

3. Research Overview

As discussed, the preparatory year is an essential factor in most international universities in order to integrate new students into university life. The preparatory year education may be unsuccessful if the strategy used is inappropriate and psychologically

affects the student by creating mental pressures or frustration on the students in completing their studies [4]. Therefore, universities have searched for ways to improve the university education process and overcome the obstacles that can be encountered. One of the most prominent obstacles is the large gap in the teaching process. In this context, many investigations have been carried out to narrow down the gap, but any innovative idea or experience needs to be analyzed carefully for successfully achieving the results. The current study identified the most important obstacles in the preparatory year teaching process and proposed a new innovative solution by presenting a general teaching strategy for the preparatory year subjects that was applied to the computer science course at the Lower Saxony State Center of the University of Hanover in Germany, which is responsible for the operation of the preparatory year.

The proposed strategy is based on a substantial role that links and integrates students with undergraduate education, which is more essential than mastering them based on the curriculum. Besides, the present study recommends the implementation of this strategy in the universities of the Kingdom of Saudi Arabia on the one hand, as well as adaptation of this strategy for the rest of the specialized courses in the preparatory year on the other hand.

Study Terms

Teaching Strategy "Achieving Connectivity": It was previously defined after posing the study problem as a new innovative teaching strategy used in the planning and development of the curriculum for the preparatory year. The strategy focuses on the goal of connecting students to the university because it is more important than mastering the subject. It consists of two phases in which the first step is to develop a general teaching strategy regardless of the subjects to be taught this year by trying to make use of the elements of the learning process as much as possible (teacher, student, curriculum, method, and classroom). The second step is to adapt this general teaching strategy and adjust it for each course in the preparatory year to ensure the outputs are defined for each course.

Preparatory Year: It is the first university year aimed at preparing students and facilitating their transition from school life (indoctrination method) to university life (self-learning, searching for information, and going deeper).

Study Objectives

1. To identify the obstacles to the integration of students in the teaching process in the preparatory year.
2. To detect the gap between schools and universities in the teaching process (difference in educational level).
3. To propose a new teaching strategy for narrowing the gap mentioned and facilitating the link for students to university life.

Study Questions

1. What are the obstacles that affect the integration of students in the teaching process in the preparatory year?
2. What difficulties does the teacher face in teaching the preparatory year courses?
3. What is the strategy for teaching the curriculum in the preparatory year?
4. Are the elements of the educational process always available (teacher, student, curriculum, method, and classroom)?

Study Importance

The teaching strategy presented in this paper is most important as it is based on the development of the curriculum for the preparatory year in order to narrow the gap between the

secondary school education and the scientific level required at the university which is a fundamental requirement for the students.

The importance of this study stems from the importance of the preparatory year in achieving the goal of connecting students to undergraduate education, which has become one of the most serious issues faced by the operators of the preparatory year. In addition to that, it also highlights the importance of the possibility of success in implementing the proposed strategy in Saudi universities after its implementation at the University of Hanover in Germany.

Study Limits

1. *Spatial boundaries:* This study was limited to the implementation of the strategy in the Lower Saxony State Center of the University of Hanover in Germany, in addition to the proposal of applying it in the preparatory year at the universities of Saudi Arabia and Arab universities.
2. *Time limits:* This strategy was applied in 2016 in Germany and suggested for Saudi Arabia universities in 2019.
3. *Human Boundaries:* This strategy was applied to preparatory year students in Germany and suggested to preparatory year teachers in Saudi Arabia.
4. *Subject limits:* It is limited to the subject of the teaching strategy called "Achieving Connectivity".

Study Evaluation

To evaluate the proposed strategy applied to the course of computer science, a questionnaire was made and students were asked to answer its questions to see how much the application of this strategy was beneficial to them. The most important factors used in the evaluation were:

- The total number of students per class.
- The satisfaction of students on implementing the strategy in the teaching process (the role of integrating the students with undergraduate education).
- A strong correlation between material content and reality (practical life).
- The degree of dependence on self-reliance (self-learning) and search for information.
- The degree of benefit from the interactive method (method of giving lectures by students).

4. Related Work

Several studies and teaching methods related to the preparatory year have been presented in the literature by various scholars. Generally, any teaching strategy may contain several elements in the entire educational process such as teacher, student, curriculum, method, and classroom [5]. The need to possess critical thinking skills [6], panel discussions that could be used as a tool to promote the school to university transitions [7], developing the relationship with the student advisor in student success through advising [8], feedback on writing skills in English language teaching programs [9] have been suggested by several researchers. A critical analysis has been made to prepare for university life and the absence of a clear philosophy for the preparatory year [10]. The need for radical changes in the organizational structure of the preparatory year and encouraging students to engage in scientific programs to overcome the challenges they face have been analyzed [11, 12]. A proposal to shift from the preparatory year to the preparatory program by applying practical practices directed to students before completing high school has been suggested [13].

The appropriate standard to develop the reality of the management of the preparatory year programs in Saudi universities, including several different axes has been proposed [14]. The idea of redesigning professional development programs to develop the capabilities of teachers and supervisors in the preparatory year to keep pace with the development in education in general, in addition to teaching English has been recommended [15].

Obviously, learning personal skills, such as communication skills, information technology, and research skills must be a part of the academic curriculum [16]. Robert A. Kennedy presented the strategies of thoughtful planning for the following four preparatory year programs: effective teaching methods, interaction, development, and continuing education. The researcher focused on integrating academic content with critical thinking skills [17]. The relationship between academic disciplines and labor market requirements have been analyzed to qualify the graduates for the labor market [18]. Most of the research focused on the use of computers at secondary schools as well as the obstacles of the educational process including the Basyouni study 2001 in Egypt [19], the Al-Adimi study 2002 in Yemen [20], and Zamal study 2009 in Palestine [21] and Omar Musa Al-Hassan Omar at secondary schools in the state of Khartoum 2018 [22].

Thus, the preparatory year highly contributes to enlightening the excellence of graduates and deliver them essential skills for the labor market [23]. However, the academic and student opinions generally vary on familiarizing the preparatory year to universities to prepare for integration and transition to university life. But based on a study nearly 10% of students withdrew during the preparatory year due to strong pressure [24]. Though the students are trained with some precise skills such as learning English, developing computer programs, and building personal skills, in addition to some key subjects that provides an opportunity to learn the university system before the actual entry of the university, some universities failed in implementing the appropriate solutions since instead of bridging the gap between higher education and public education, the preparatory year contributed towards creating another gap between them.

In summary, many research related to the preparatory year found that most of them focus on the following: The concept of the preparatory year and its origin, the organizational structures, the mechanism of operation, the plans and programs used therein, and the quality study, in addition to the integration of the preparatory programs with post-university education, and keeping pace with the needs of the labor market. Based on the knowledge obtained from the literature related to the research field, the paper innovates a new general teaching strategy for preparatory year subjects and focuses on narrowing the gap between the scientific level at schools and the scientific one at universities. Also, the conclusion of the need to study the amendment of this general strategy in teaching and adapt it to suit the process of applying it to each specialized course in the preparatory year.

5. Achieving Connectivity – A General Strategy

Based on the idea of having a preparatory year and its importance in preparing students for the undergraduate level and helping them to choose the appropriate scientific disciplines for their level and variety of skills, it is necessary to develop a general teaching strategy as a first step in which the preparatory year should be run successfully regardless of the subjects that are taught in this year. This means that this general teaching strategy must be valid for all preparatory year courses. Therefore, this strategy should represent the teaching methodology that aims to raise the level of students effortlessly from the school level to the university level. Additionally, as the preparatory year education may psychologically affect the student if it is

not studied thoroughly, the new strategy eliminates all the pressures or frustration that may be placed on the student.

The overall structure of the general strategy of "Achieving Connectivity" is presented in Figure 1. This strategy tries to take full advantage of the elements of the entire educational process including teacher, student, curriculum, method, and classroom.

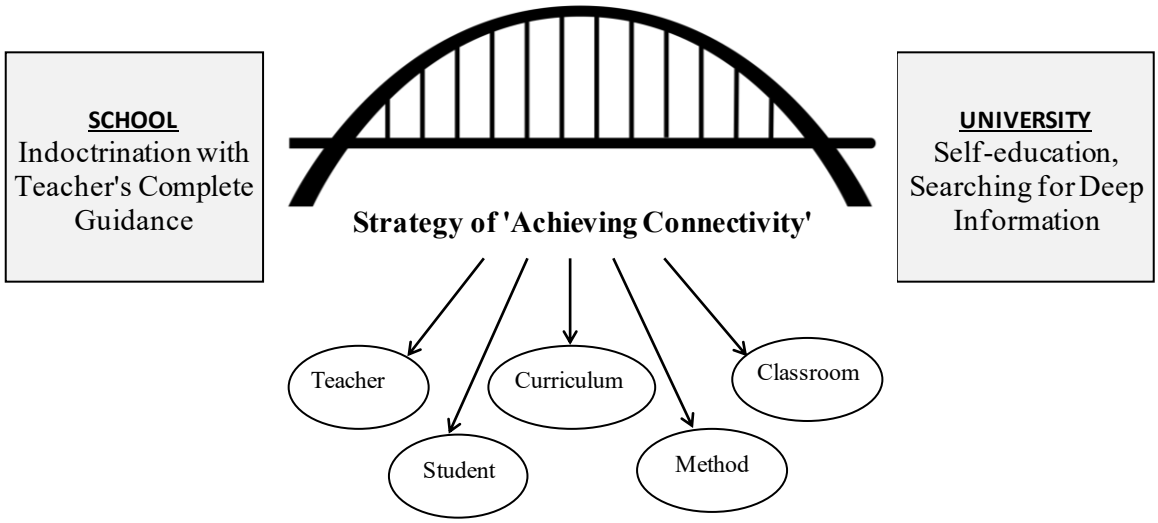

Figure 1. Overall Structure of the General Strategy of "Achieving Connectivity"

One may ask how the courses in the preparatory year will be taught using a general strategy? The answer is that this general strategy must be adapted to each curriculum in the preparatory year to suit the outputs required for each course according to the operational plan of the preparatory year. This process of adaptation is considered as the second step in the idea of the strategy used (this is described later in this article and applied to the computer science course in the preparatory year). Here, the strategy of teaching a computer science course may be different from that of teaching English, physics, or other courses.

The workflow of the proposed General Strategy of "Achieving Connectivity" for the operation of the preparatory year that specifies the two step process is depicted in Figure 2. Towards the implementation of the proposed strategy, the first step is to develop a general strategic plan (Strategy X) regardless of the course of the student. Here the students are commonly prepared to adapt to the university. On the other hand, in the second step, the specific strategic plans concerning the course are developed in order to make the students to adapt to the course.

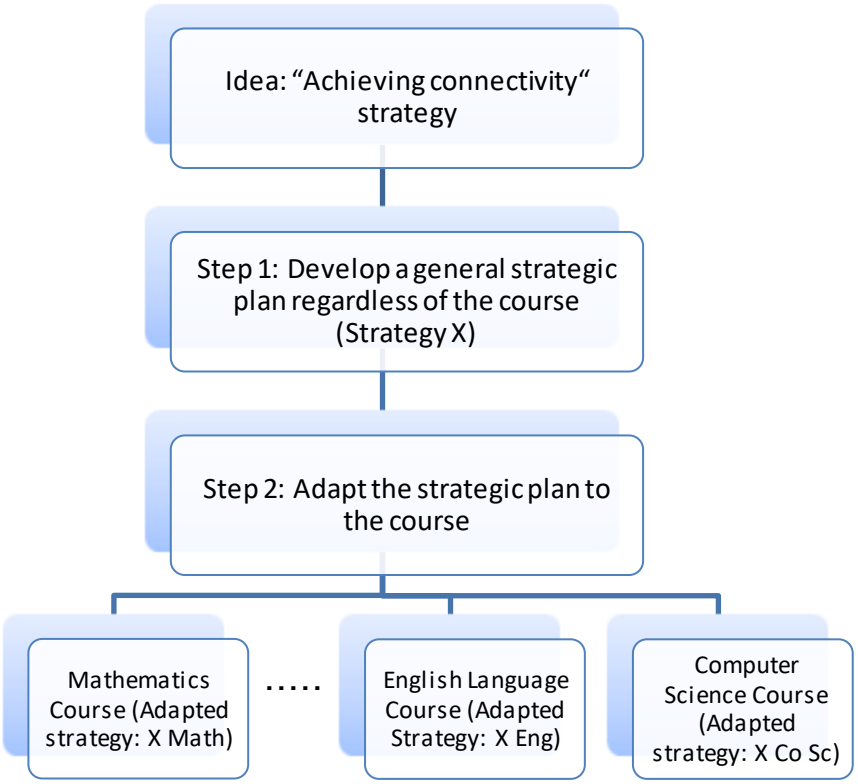

Figure 2. The workflow of the General Strategy of "Achieving Connectivity" for the Operation of the Preparatory Year

The teaching and learning process can be modified in a certain way to create a huge difference in the gap between high school and university education. Thus, the overall objective of the proposed strategy can be achieved by providing certain approaches for the teaching process to be carried out by faculty members and certain methods in the learning process to be carried out by students for achieving success in the proposed model.

Teaching Process

The "Achieving connectivity" strategy uses several ideas for teachers to accomplish the desired goal of narrowing the gap between school and university education.

- The teacher's focus on the uses of scientific material and the places of its application (perhaps mentioning its applications).
- Focus on explaining only key concepts and important terms in the course without going into theories or proofs.
- Emphasis on giving only an introduction in each item of scientific content.
- Delivering lectures (presentations) by students under the supervision of the teacher. The degree of using the method of lecturing (giving presentations) varies greatly depending on the course and its scientific content (it may be used largely in the course of computer science).

Learning Process

As with the teaching process, the learning process also creates a huge impact on the output of education at any level. In the preparatory year, the method of giving lectures or presentations by students is a wonderful interactive method and plays an important role in the

educational process. This creates a huge difference in the students' minds and increases the maturity level. Some of the advantages of student presentation are:

- Enhance student's self-confidence through speech.
- Learn to search for a topic.
- Go deeper and discuss ideas.
- Understanding the lecturing method (giving presentations).
- Interact with other students by asking and answering questions.
- Learn a wide range of important topics related to the subject (scientific material).

The proposed strategy "Achieving connectivity" in the preparatory year is a general strategy that can be applied to any of the courses, however, in this study, it has been tried, applied, and adapted to the Computer Science course (adapted strategy X Co Sc) at the Preparatory Year Center of the State of Lower Saxony of the University of Hanover, Germany. This strategy achieves the aforementioned objective and has shown outstanding success at the level of students.

6. General Strategy "Achieving connectivity" - Adaptation to a Specialized Course

The preparatory year contains many courses and their teaching varies according to the nature of the underlying subject. Therefore, the adaptation of the general strategy is essential for the success of the educational process of these courses.

Suitability to be Applied to Each Specialized Academic Course:

The second step is the step of adaptation and adjustment of the general strategic plan. This step is significant because each course has its own specificity and thus a deep analysis must be taken into account in framing the curriculum that is used during teaching. Based on the knowledge obtained from the analysis, a plan adapted to each course can be developed.

Suitability to be Applied to the Course of Computer Science:

As mentioned earlier, our strategy presented here has been adapted, tested, and applied to the Computer Science course at the Preparatory Year Center of the Lower Saxony State of the University of Hanover, Germany. Hence, the methods used to make students love and be eager for scientific content concerning the computer science course is presented in detail.

- *Delivering Lectures (Presentations) by Students Under the Supervision of the Teacher:* It has been used a lot as we are living today in a permanent revolution in the world of computer and technology. The other reason, each student could be proficient in a subject in this field or he/she is at least familiar with an idea that he/she can research, expand and present in a simplified way to his/her fellow students. Each student chooses a subject related to the course of computer science or the techniques used in coordination with the course teacher to ensure quality and accuracy. The student then prepares the topic and explains it to the students using electronic aids such as slideshow programs within a specific time limit of only 10 minutes and then 5 minutes to answer the questions of students and teacher.

Some of the selected topics may include SpyWare, Li-Fi, 3D printer, Nanochips, Networks, Internet of Thing, Tablet PC, Search Engines, Cloud Computing, Super Computer, SSD, Android, Data Mining, Smart Watch, Data Structure, Servers, other recent technologies and so on.

- *Explaining Some Important Applications that Benefit Students in the Undergraduate Education:* For example, instead of explaining commands and how to use MS-Word to write a paper, teaching how to write a graduation project or any book or essay (via MS-Word or Latex) can be taught in such a way to delete and add chapters to the book or project automatically. This is important when the project is modified by the supervisor so that most of the formatting issues (labeling, references, table of contents, etc) in the program are automatically addressed.
- *Defining Significant Terms related to the Course:* Many basic concepts have been explained and many important terms used in computer science have been defined without going into details.
- *Describing Internal Working of Computers:* Emphasis was placed on explaining the introduction to operating systems and other system software that contributes to the internal working without exposure to the details of every computer operating system.
- *Providing Introduction to Programming Language:* In terms of programming and its languages, important terms (terminology) used in programming have been defined and the well-known programming principle OOP (Object- Oriented Programming) has been explained in a very simplified manner, in addition to giving an introduction to the JAVA language that is famous for the application of the principle OOP for easy understanding. Finally, a set of small and simple programs were written to perform calculations using Java. It has been noted that students are highly integrated with the scientific content and their great passion for the most important thing in computer programming. As for the results of the exams, there was a noticeable increase in the students' scores after applying the general strategy of "achieving connectivity" and adapting it to the course of computer science compared with previous years before applying the strategy.

7. Factors Used in Evaluating the Proposed Strategy in Computer Science Course

To evaluate the strategy mentioned in this article, a special questionnaire was distributed to the students in order to see how beneficial the application of the strategy on the computer science course (subject) was to students. It is worth mentioning that the questionnaire was in German as the subject was taught in Germany. The five alternatives used to answer each paragraph in the evaluation are I strongly agree, I agree, Neutral, I disagree, I strongly disagree.

The evaluations were done based on the following steps (the most important factors):

1. *The total number of students per class:* The number of students per class ranged from 15 to 25 students, where each classroom for the computer science course contains a Mobile Laptop/Notebook Storage Cabinet that holds up to 25 laptops. This cabinet can be moved easily and safely due to its wheels and serves for professional storage of laptops as depicted in Figure 3. Therefore, it was almost complete consensus among the students that the number of students in the classroom is appropriate to apply this strategy in the teaching of the subject. As a result, the consensus was about 80% of students on their consent (I strongly agree) that the implementation of this strategy in teaching the subject would be beneficial for students who wish to enroll at the university in their branch. The researcher attributes this to the provision of a laptop for each student as it played an important role in achieving the desired goal of the strategy because the computer science course needs a practical application to achieve the required connectivity mentioned earlier during this research.

Figure 3. Mobile Laptop/Notebook Storage Cabinet

2. *Students' satisfaction with the application of the strategy in teaching the subject (The role of linking and connecting between students and undergraduate education):* Regarding the paragraph, did you feel the difference between the method of teaching computer science and the method of teaching other courses of the preparatory year? Nearly 95% of the students had a near-total consensus (I strongly agree) that the difference was clear. The rate of satisfaction with the application of this strategy in the teaching of computer science was about 90% agree very significantly (I strongly agree), Additionally, some 93% of the respondents expressed their approval to a large extent (I strongly agree) that this strategy succeeded in narrowing the gap between the scientific level in schools and the scientific level in universities. However, about 10% of students believed that there were other methods of teaching that results better than this strategy used in teaching other courses of the preparatory year. The researcher explains that some students may not be convinced by the method of this strategy, especially giving lectures (presentations) by students (too scared) and to be subjected to open, multiple and accurate questions on the subject by other students and teacher as well (impact of embarrassment sometimes).
3. *A strong correlation between material content and reality (practical life):* As for the question, is this strategy applied in the teaching of computer science strongly linked the content of the subject with reality (working life)? 90% of students strongly agreed (I strongly agree) that the association was strong. However, the question of whether this strategy relied more than necessary on linking the content of the material to working life was about 15%. The researcher attributes this to the fact that some students were not used to link the scientific content with reality in previous years of education.
4. *Degree of dependence on Self-reliance (self-learning) and search for information:* As for the question, have you benefited from the idea of self-education and research applied in this strategy? There was a great consensus about 95% of the students strongly agreed (I strongly agree) that the benefit was significant. On the other hand, the question of whether this strategy relied heavily on the idea of self-education and research was about 10%. The researcher explains that some students are not used to self-education or self-research before in the educational process.
5. *Degree of benefit from the interactive method (the method of giving lectures, presentations, or seminars by students):* The first question to measure this factor was whether you benefited from the interactive method by giving seminars associated with the course? About 90% of students strongly agreed (I strongly agree) that the utilization of the interactive method was to a great extent. However, about 10% of the

students believed that this strategy relied very much on giving seminars related to the subject. The researcher attributed this to the fact that some students did not want to give presentations because they had no previous experience in this matter or they were embarrassed when they could not answer some of the audience's questions (students and teacher).

8. Result Analysis

Any research is valid only if it is proved to be efficient and produces good results. The analysis has been carried out to analyze the performance of the proposed new strategy "Achieving Connectivity". The Questionnaire used for the evaluation is mentioned in Appendix and it has been used framed by the joint effort of academic experts particularly in the field of computer science.

The statistical analysis has been made for the answers given by the students for the given Questionnaire based on each category. The Questionnaire was distributed to 25 students and analysis was done based on the response given by the students for 5 different options. Table 1 presents the result analysis for 25 students (n) based on the statistical analysis on the number of students who stand in each particular option for each question (m). Thus, the results are represented in percentage in which m represents the number of students at each different option for the given students.

Table 1. Result Analysis based on the Questionnaire (n=25)

Various Criteria	**Degree of approval**				
	I strongly agree % (m)	I agree % (m)	Neutral % (m)	I disagree % (m)	I strongly disagree % (m)
	5	**4**	**3**	**2**	**1**
The total number of students in this classroom:	**25**				
First Area: General Information					
Is the strategy considered appropriate for implementation	80(20)	8(2)	4(1)	4(1)	4(1)
Second Area: Students' satisfaction with the application of the strategy in teaching of the subject					
I felt the difference between the method of teaching computer science and the method of teaching other courses of the preparatory year	92(23)	4(1)	4(1)	0(0)	0(0)
I am satisfied with the application of this strategy in teaching computer science	88(22)	8(2)	4(1)	0(0)	0(0)
This strategy succeeded in narrowing the gap between the scientific level in schools and the scientific level in universities	92(23)	4(1)	4(1)	0(0)	0(0)
There are other methods of teaching better than this strategy used in teaching other courses of the preparatory year	8(2)	0(0)	12(3)	16(4)	64(16)

Follow Table 1. Result Analysis based on the Questionnaire (n=25)

Various Criteria	Degree of approval				
	I strongly agree % (m)	I agree % (m)	Neutral % (m)	I disagree % (m)	I strongly disagree % (m)
	5	**4**	**3**	**2**	**1**
Third Area: A strong correlation between material content and reality (practical life)					
This strategy applied in teaching computer science strongly linked the content of the subject with reality (working life)	92(23)	4(1)	4(1)	0(0)	0(0)
This strategy applied in teaching computer science relied excessively on linking the content of the subject to reality (working life)	16(4)	0(0)	4(1)	12(3)	68(17)
Fourth Area: The degree of dependence on self-learning and research					
I benefited from the idea of self-education and research applied in this strategy	96(24)	4(1)	0(0)	0(0)	0(0)
This strategy relied excessively on the idea of self-education and research	8(2)	0(0)	16(4)	12(3)	64(16)
Fifth Area: The degree of benefiting from the interactive method (the method of giving seminars or presentations by students)					
I benefited from the interactive method by giving seminars associated with the course	92(23)	0(0)	4(1)	4(1)	0(0)
This strategy relied excessively on giving seminars related to the subject	8(2)	0(0)	12(3)	12(3)	68(17)

From the table, it is clear that at each criterion of the proposed methodology, the percentage is high for the "I strongly agree" option which states that the new strategy is beneficial. As the table shows the result in a detailed manner, it is very difficult to understand the results more crisply. Thus, the values in Table 1 are consolidated and the average values are computed for each area and the consolidated result is presented in Table 2.

Table 2. Consolidated Result Analysis

Various Criteria	Percentage of Students				
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**strongly Disagree**
First Area	80	2	1	1	1
Second Area	70	4	6	4	16
Third Area	54	2	4	6	34
Fourth Area	52	2	8	6	32
Fifth Area	50	0	8	8	34

The values presented in Table 2 is also depicted as a graph for clear understanding in Figure 4. Though it is clear that at the most 80% of the students strongly satisfied with the proposed strategy in the preparatory year, nearly 23 students strongly satisfied with at least

any of the 4 criteria among 5 used in the analysis which can also be considered as strongly agreed with the implementation of the proposed new strategy.

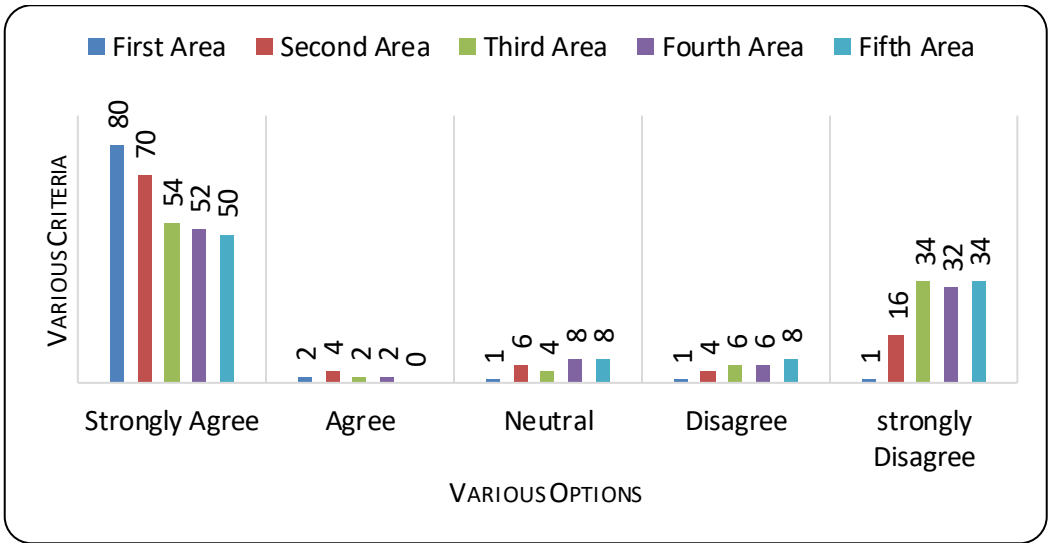

Figure 4. Consolidated Result Analysis

Thus, 92% of the students agreed to the benefit of the different ideas and procedures used in the teaching and learning process followed in the new strategy "Achieving Connectivity" and this proves the success of the proposed strategy "Achieving Connectivity" in the for Preparatory Year Teaching methods.

9. Comparison with the Closely Related Work

Al-Husseini discussed the preparatory year experiences in Saudi universities and strongly recommended re-study the preparatory year concepts in Saudi Arabia [24]. With this work as a base, the demonstration of the "Achieving Connectivity" general strategy's similarities have been carried out and the results are summarized and differences with closely related work have been discussed:

- Al-Husseini mentioned that the preparatory year in universities of Saudi Arabia was not able to bridge the gap between higher education and public education. Consequently, it needs to re-study the preparatory year concepts/programs and to propose new general strategies/mechanisms aiming to bridge that gap between scientific level in schools and universities.
- Al-Husseini added that King Saud University presented its study on the preparatory year, and concluded that about 10% of students withdrew during the preparatory year. The reason could be that a big gap was discovered earlier.
- Al-Husseini pointed out that Dr. Nizar Hussein Al-Saleh, the General Secretary of the National Center for Youth Issues Research at King Saud University, concluded that the dropout from the preparatory year was because of not using a scientific teaching strategy. We do not need to put strong pressure on students.
- Al-Husseini mentioned that Dr. Fadwa Salama Abu Marifa, a member of the Shura Council concluded that the preparatory year created another gap between higher education and public education. Additionally, she referred that novel solutions/alternatives are required so that the preparatory year can be evaluated by considering useful teaching strategies.

Consequently, this summary serves as an overview/result of selected related work and the abilities they lack in comparison to the "Achieving Connectivity" general strategy developed in this paper. According to the previously discussed studies and based on the results presented in [24], the preparatory year lacks a general teaching strategy that can narrow the gap mentioned above. To overcome this shortage, this paper suggests "Achieving Connectivity" as a general teaching strategy so that it can be adapted to suit each specialized course in the preparatory year. Furthermore, computer courses were chosen as a model in this paper and consequently, this strategy was applied in computer teaching. The result analysis of the performance of "Achieving Connectivity" showed efficient and good results, where a special questionnaire was used for the evaluation. Consequently, the application of the proposed strategy on the computer course was beneficial, because the percentage was high for the "I strongly agree" option in all steps of the methodology used for evaluating the strategy, as described later. This led in turn to bridge the gap between higher education and public education, where there is no reason more for the dropout from the preparatory year.

10. Conclusion

This article presents a new strategy called "Achieving Connectivity" for the preparatory year teaching. It relies on two steps to run in which the first step develops a general strategic plan for teaching the course (irrespective of the course), and the second, adapt the strategy to suit each specialized course individually. Hence, these steps can be applied to each course in the best way. Previous research related to the preparatory year mainly focused on the concept of the preparatory year and its origin, the organizational structures, the mechanism of operation, the plans, and the programs used in it. But this new strategy innovates a new general teaching strategy for preparatory year subjects and focuses on narrowing the gap between the scientific level at schools and the scientific level at universities. This strategy was successfully applied to the development and teaching of the curriculum of the Computer Science course at the Preparatory Year Center of the State of Lower Saxony of the University of Hanover in Germany. The feedback was tested by distributing a special questionnaire to the students in order to see how beneficial the application of this strategy on the computer science course (subject) was to students. From the analysis, it is clear that 90% and above students strongly agreed to the benefit of the different methods followed in the new strategy "Achieving Connectivity" in one way or the other.

Study Recommendations

This study recommends further research on this new strategy and identification of the modalities that can be used to adapt this general strategy to make it suitable for application to any course of the preparatory year. Thus, a computer science course has a teaching strategy that differs from that of Physics, English, or others, as each course must be taken into account during teaching to achieve a high level of understanding and interaction with students. This study also recommends the search for the best way to apply this strategy in Saudi universities which facilitate the integration of preparatory programs and their development to meet the needs of the labor market desired for the Saudi National Vision 2030.

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Appendix

Questionnaire to evaluate the teaching strategy "Achieving Connectivity" applied to the computer science course by students

Various Criteria	Degree of approval				
	I strongly agree	I agree	Neutral	I disagree	I strongly disagree
	5	4	3	2	1
First Area: General Information					
The total number of students in this classroom:					
The number of students in the classroom is appropriate to apply this strategy in the teaching of the subject					
The branch of study to be enrolled in the university ☐ Scientific ☐ literary					
The implementation of this strategy in teaching the subject would be beneficial for all students who wish to enroll at the university in the same branch that I want					
Second Area: Students' Satisfaction with the Application of the Strategy in Teaching Subjects					
I felt the difference between the method of teaching computer science and the method of teaching other courses of the preparatory year					
I am satisfied with the application of this strategy in teaching computer science					
This strategy succeeded in narrowing the gap between the scientific level in schools and the scientific level in universities					
There are other methods of teaching better than this strategy used in teaching other courses of the preparatory year					
Third Area: A Strong Correlation between Material Content and Reality (practical life)					
This strategy applied in teaching computer science strongly linked the content of the subject with reality (working life)					
This strategy applied in teaching computer science relied excessively on linking the content of the subject to reality (working life)					
Fourth Area: The Degree of Dependence on Self-learning and Research					
I benefited from the idea of self-education and research applied in this strategy					
This strategy relied excessively on the idea of self-education and research					
Fifth Area: Degree of Benefiting from the Interactive Method (method of giving seminars or presentations by students)					
I benefited from the interactive method by giving seminars associated with the course					
This strategy relied excessively on giving seminars related to the subject					