Evaluation Methods of Education Outcomes Quality in Universities (A Case of Syria)

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Abstract

Total quality in higher education has become a target for all universities in the world. Student education outcomes are rapidly taking center stage as the principal gauge of higher education's effectiveness. Research has mainly focused on the quality of inputs and processes in higher education, but does not provide a sufficient attention to the outcomes (the level of graduates). In order to address this issue, we studied some possible indicators to evaluate the quality of education outcomes (in courses, classes, or the faculty as a whole) by analyzing students' grades in the courses. We were able to adopt several indicators that rely on calculating the means and ratios of students in courses, classes, and the faculty as a whole. In addition, we provided suitable indicators to assess the quality of education outcomes for graduates and distinguished students, and estimate the ratio of distinction via special calculations for graduates and distinguished students.

Keywords: education outcomes, outcomes quality, quality indicators, students' evaluation methods, quality in universities.

I- Introduction

Quality is a noble human target, and it has become a new symbol for superiority in performing work in all fields of life. The topic of quality has always been of utmost importance, originally in business, but now in education and other public services sectors. Quality differs in its objectives, meanings, and contents from sector to another. It is also influenced by a number of qualitative and quantitative factors raised from the objectives, inputs, processes, and outputs of that sector.

There is a need to understand the different philosophy, which predominates quality in the business sphere and that in the public services. Within the industrial/business setting the philosophy over the past 50 years has focused on the training of employees to prevent problems, strengthening organizational systems, and continually improving performance. While within public service areas such as health and education, the philosophy has been based on taking a watchdog approach, relying on government controls, professional credentials, internal audits, and, more recently, external inspections to maintain standards, weed out poor performers, and solve problems.

Quality is often described as the totality of features and characteristics of a service that bear on its ability to satisfy stated or implied needs. Quality in higher education, according to Article 11 of the World Declaratio on Higher Education published by the United Nations, is a multi-dimensional concept, which should embrace all its functions and activities: teaching and academic programmes, research and scholarship, staffing, students, buildings, faculties,

equipment, services the community and the academic environment. It should take the form of internal self-evaluation and external review, conducted openly by independent specialists. Independent national bodies should be established and comparative standards of quality, recognized at international level, should be defined. Due attention should be paid to the specific institutional, national and regional contexts in order to take into account diversity and to avoid uniformity. Stakeholders should be an integral part of the institutional evaluation process. Quality also requires that higher education should be characterized by its international dimension: exchange of knowledge, interactive networking, mobility of teachers and students, and international research projects, while taking into account the national cultural values and circumstances.

It is known that quality in education is not a tangible thing which could be measured in laboratories. It is the product of complicated processes which is composed of physical, human, financial, managerial, and other factors. An educational definition of quality is that of an ongoing process ensuring the delivery of agreed standards. These agreed standards should ensure that every educational institution where quality is assured has the potential to achieve a high quality of content and results. Bergquist (1995) proposed that a comprehensive and useful definition of quality in higher education must include all four sets of criteria: input, output, value-added, and process-oriented. The four sets of criteria must be considered equally important in developing a modern definition of quality for education. The four sets of criteria are as follows (Maguad, 2010):

Input criterion: focuses on the nature and level of resources available to the institution like the characteristics of incoming students, credentials of faculty, size of library, structure and availability of physical facilities, and the amount of financial reserves.

Output criterion: stresses the nature and extent of institutional products, characteristics of graduating students, success of alumni, research and scholarly publications, and public service.

Value-added criterion: zeroes on the differences that an institution has made in the growth of all of its members: intellectual, moral, social, vocational, physical, and spiritual.

Process-oriented criterion: includes the level and manner of participation of all appropriate constituencies (or stakeholders) in the educational, administrative, and governance processes of the institution, including the defining and assessing of quality.

As the definition indicates, the “output criterion” is the accomplishment of the education institution mission, and the very important of its mission is the characteristics of graduating students (outcomes). “Quality is the extent to which an institution successfully directs adequate and appropriate resources (input) to the accomplishment of its mission-related outcomes (output) and that its programs make a significant and positive difference in the lives of people associated with it (value-added) and that these programs are created, conducted, and modified in line with the mission and values of the institution (process)” Bergquist (1995, p.43). For the quality of outputs to be achieved, the quality of other criteria must be met. Any default would happen in these chain elements, would impact negatively on the quality of outputs, and in turn on the quality of education. This paper mainly focuses on the “output criterion” using quantitative methods to evaluate their performance in Syrian universities.

II- Literature Review

Education is a complex business with many interacting dimensions of quality in many varied contexts. To understand what is going on it is necessary to have a way of conceiving of the variables involved and of organizing and interpreting studies of the relationships between these variables. Some researchers adopt the commonly used '3P' model (Biggs, 1993), which approaches education as a complex system with 'Presage', 'Process' and 'Product' variables interacting with each other. The '3P' model is essentially the same as that used by large-scale studies in the US (e.g. Astin, 1977, 1993): the 'input-environment-output' model.

Presage variables are those that exist within a university context before a student starts learning and being taught, and include resources, the degree of student selectivity, the quality of the students, the quality of the academic staff and the nature of the research enterprise. None of these presage variables determine directly how the educational process may be conducted, although they often frame, enable or constrain the form education takes.

Process variables are those that characterize what is going on in teaching and learning and include class size, the amount of class contact and the extent of feedback to students. Process variables also include the consequences of variables such as class size for the way students go about their learning, e.g. how those variables impact on the quantity and quality of their study effort and their overall level of engagement.

Product variables concern the outcomes of the educational processes and include student performance, retention and employability. Products can also include psychometric measures of generic outcomes of higher education, such as students' ability to solve problems. In some studies the key product measure is not student performance, but **educational gain**: the difference between performance on a particular measure before and after the student's experience of higher education.

In the UK the measure most commonly used to indicate the quality of the outcome of higher education is the proportion of students gaining upper second class or first class degrees. The proportion of students who gain 'good degrees' has increased very markedly over time, although unevenly across institutions and subjects (Yorke, 2009). In Syria, the percentage of successful students is calculated without mentioning the proportion of good degrees. At the same time presage and process indicators of quality (such as funding per student, the quality of student intake, class size, amount of close contact with teachers and amount of feedback on assignments) have declined. Yorke (2009) suggests a whole list of reasons why this counter-intuitive phenomenon has occurred. For example, the proportion of assessment marks derived from coursework has increased and coursework usually produces higher marks than examinations (Gibbs and Lucas, 1997).

The key problem appears to be that there has been little to stop grade inflation. The external examiner system has not proved capable of maintaining the standards that are applied by markers to whatever quality of student work is being assessed. As a consequence degree classifications cannot be trusted as indicators of the quality of outcomes (Gibbs, 2010).

It has been argued that there is no longer any meaningful sense in which degree standards are comparable (Brown, 2010). There has been persistent criticism of the meaning and

interpretability of degree classifications as indicators of educational outcomes (e.g. House of Commons, 2009) and these arguments have been largely accepted, e.g. by the QAA (2006), and so the arguments will not be rehearsed here. What is clear is that degree classifications do not currently provide a sound basis for indicating the quality of educational outcomes.

Since the early 1980s quality has become a central concept in many discussions on higher education. In the United States and Canada the debates on the various approaches and instruments with respect to quality assessment have intensified. In the United Kingdom (in 1984) quality was declared to be a principal objective for higher education. In France the 'Comite National d'Evaluation' was set up. In the Netherlands an influential policy-paper was published in which quality played a major role. In Denmark, Finland, Spain and several other countries the first steps were taken to design a quality assessment system (Neave and van Vught, 1991).

The increasing costs of higher education systems had to be legitimized by clearly definable societal benefits. And for this, mechanisms and procedures of quality assessment were deemed to be necessary. New systems of quality assessment and quality control have been (or are being) developed in several countries. In the Berlin communiqué of 19 September 2003 the Ministers of the Bologna Process signatory states invited the European Network for Quality Assurance in Higher Education (ENQA) 'through its members, in cooperatio with the EUA, EURASHE, and ESIB', to develop 'an agreed set of standards, procedures and guidelines on quality assurance' and to 'explore ways of ensuring an adequate peer review system for quality assurance and/or accreditation agencies or bodies, and to report back through the Bologna Follow-Up Group to Ministers in 2005'. The Ministers also asked ENQA to take due account 'of the expertise of other quality assurance associations and networks' (ENQA, 2009). This report is a list of European standards for quality assurance in higher education. The standards are in three parts covering internal quality assurance of higher education institutions, external quality assurance of higher education, and quality assurance of external quality assurance agencies. However, this paper will only illustrate the part of internal quality assurance of higher education since it focuses on the assessment of students.

European standards and guidelines for internal quality assurance within higher education institutions

1. *Policy and procedures for quality assurance:* Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programmes and awards. They should also commit themselves explicitly to the development of a culture which recognizes the importance of quality, and quality assurance, in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality. The strategy, policy and procedures should have a formal status and be publicly available. They should also include a role for students and other stakeholders.
2. *Approval, monitoring and periodic review of programmes and awards:* Institutions should have formal mechanisms for the approval, periodic review and monitoring of their programmes and awards.
3. *Assessment of students:* Students should be assessed using published criteria, regulations and procedures which are applied consistently.

4. *Quality assurance of teaching staff:* Institutions should have ways of satisfying themselves that staff involved with the teaching of students are qualified and competent to do so. They should be available to those undertaking external reviews, and commented upon in reports.
Between these standards and guidelines we will focus on the students' assessment.

The evaluation of outcomes is one of the most important elements of higher education. This evaluation has a profound effect on students' future careers. It is therefore important that evaluation is carried out using objective quantitative methods and that it takes into account the extensive knowledge which exists about testing and examination processes. Evalaution also provides valuable information for institutions about the effectiveness of teaching and learners' support.

Most studies that discussed quality issues in higher education focused on the importance of its requirements mainly in the inputs and processes. Those studies developed various questionnaires instruments to evaluate higher education quality. However, they did not consider the outputs quality issues. Therefore, this research will study and evaluate higher education quality of outputs without relying on questionnaires. Rather, we will try in this paper to deduce quantitative tools to measure the education outcomes quality. We will limit our investigation on the quality of students' gain through their marks in various courses. In order to prevent any misunderstanding we will define education quality and outcomes quality.

Education quality: For many scholars, the lack of agreement surrounding the meaning of quality in higher education suggests that the concept—borrowed from business and industry—is ill suited to the educational context. While customer-based definitions of quality have gained preeminence in business, in higher education, they are viewed as problematic for a number of reasons. First, a singular view of quality is not representative of the varied— and sometimes conflicting—views of stakeholder groups: "The key issue is the ability of the quality concept to facilitate the perspective of a range of stakeholders who have different conceptions of higher education" (Cullen, Joyce, Hassall & Broadbent, 2003, p. 6). For example, in determining whether or not their educational experience has met their expectations, students are most likely to judge quality as fitness for purpose, while faculty members are apt to measure quality in terms of inputs and outputs, such as research and productivity, number of publications, number of courses taught, etc., or outcomes such as improved student learning. In contrast, external stakeholders such as government and the public would almost certainly agree that quality equals value for money and doing more with less. Moreover, because the two university mainstays of research and teaching differ in terms of purpose, process and outcomes, they require different approaches to quality assurance (Marshall, 1998). In light of this, it is not surprising that Harvey and Green (1993) suggest that the only practical solution to this "complex philosophical question" is to recognize and validate all of these diverse perspectives and reject the possibility of accepting a singular definition of quality.

Following Nicholson (2011), quality is operatioalized in several ways including: (a) fitness for purpose (mission), (b) exceptional, and (c) value-added. For example, the criteria for the evaluation of new undergraduate and graduate programs, which include "consistency of the program with the institution's mission and academic plans" and "clarity and appropriateness of

the program's requirements and associated learning outcomes in addressing the institution's own undergraduate and graduate.

Outcomes Quality While an *outcome* is clearly a result of institutional and student activities and investments, not all results are properly considered outcomes. Numbers of graduates, numbers of credits produced through instruction, or types of service or research products generated, for example, are clearly results of what an institution does. But they are most usefully defined as *outputs* of higher education. Other dimensions of institutional or program *performance* like efficiency or productivity are equally the results of what an institution does, and assessing them may be important for some evaluative purposes. But they are not the same thing as outputs. Indeed, this is the whole idea behind the notion of *institutional effectiveness*, which examines the extent to which the institution as a whole attains all of the performance goals it establishes for itself. Although outputs and performance are predominantly institution-level terms, moreover, *outcomes* are only visible by aggregating what happens to individual students. An *outcome*, therefore, can be most broadly defined as something that happens to an individual student (hopefully for the better) as a result of his or her attendance at a higher education institution and/or participation in a particular course of study (CHEA, 2001).

Thus, the quality of outcomes is a result of interactive dimensions by various parties: university and faculty administratio, curriculum, faculty members, students, scientific sources, laboratories, examination system, and evaluation techniques. All these parties have a kind of responsibility to achieve higher education outcomes quality. However, students have the final responsibility because all efforts pour on them. As much as their desire and eager in commitment, attendance and caring about distinction and competitiveness, they achieve good learning and record good quality in higher education in any course.

III- Research Design

<u>Research Problem</u>: how to evaluate the education quality outcomes using quantitative methods? And to what extent these methods are reliable in measuring the education quality outcomes? It seems that previous studies did not provide reliable indicators or quantitative tools for measuring education quality in courses, classes, and in the faculty as a whole. This problem was raised because of the imbalance between the quality and the quantity of university outputs. The task of education has become to graduate the maximum number of students without paying much attention to learning gain. This method causes a regression in higher education in the entire world. That is why there is a call for achieving quality in higher education and improving the human cadre. Thus, it is very important to deduce a quantitative measure to express the quality of education outcomes in each course, in each class, and in the faculty as a whole.

<u>Research Importance</u>: the importance of this paper comes from developing quantitative tools to measure the education outcomes quality, since education quality has become the key factor in evaluating, classifying, and ranking universities in the world, and gives universities high reputation and a good position in the world.

<u>Research Objectives</u>: this research aims to deduce a mathematical coefficient to measure education outcomes quality in the courses and in the faculty as a whole, by analyzing

marks attained by students in each course, and by calculating graduation ratios in the faculty. We will try to find:
- Measurement of education quality outcomes in courses.
- Measurement of education quality in the classes and in the faculty as a whole.
- Measurement of graduates quality (outputs).

<u>Research Methods</u>: a deductive approach is used to study possible coefficients and comparing them to find the suitable indicators. Students' grades were collected from their records in the examination department in the Faculty of Economics at Tishreen University, and from the their records in the Unified Medical Examination. Based on data collected, some formulas were provided and results were compared.

IV- Educational System characteristics in Syria

The Ministry of Higher Education was established in 1966 to supervise the scientific and educational institutions, such as, universities, academic councils, and educational hospitals. Most post-secondary education is state provided, but legislation passed in 2001 allows the establishment of some private universities and colleges. Resources for education have risen in absolute terms over the past decade, but it is difficult to match the rate of population growth.

Domestic policies emphasize engineering and medicine in Syrian universities, with less emphasis on the arts, law, and business. Most universities in Syria follow the French model of higher education, the university stages and the academic degrees are:

First stage: the License awarded after 4 years to 6 years depending on the field.

Second stage: the DEA or DESS 1–3 years postgraduate degree equivalent to the Master's degree in the American-English systems.

Third stage: the doctorate 3–5 years after the DEA or an equivalent degree.

Study period: in medicine faculties is 6 years, in engineering faculties 5 years, in other faculties such as science; economics, arts; education; and law is 4 years.

Semester system is followed; there are two semesters in each academic year. The period of each semester is 16 weeks. After each semester, there is an examination for 3 weeks. The requirement for doing exams is to attend courses (attendance percentage should be not less than 70%). The number of courses in each semester ranges from 6 to 7 courses. Courses total ranges from 70 to 80 in the faculty. Each course has 3 to 4 hours weekly.

Each course has a 100 degree. The minimum degree for passing the courses is 60 for applied faculties. Thus, the degrees of students are distributed within the range [0,100]. But the degrees of passing student would be distributed within the range [60, 100]. Student would not move to the higher year if he failed in more than 4 courses. For graduation,

students should pass all the courses in the faculty. The general rate of the students is calculated by dividing the total degrees of the student by the number of courses in the faculty (or the mean of yearly ratios). We will use the following scale presented in Table 1 to evaluate the level of quality.

Table1: A scale used for evaluating the level of quality

value	Less than 50	[50 - 60[	[60-70[	[70-80[	[80-90[	[90-100]
rank	weak	accepted	moderate	good	very good	excellent

V- Measurement Techniques of Higher Education Quality

As mentioned above, for evaluating education outcomes quality, we have to search for an indicator or more to measure the whole dimensions of education outcomes quality. Firstly, an indicator to measure the quality of students' learning from examination. Secondly, an indicator to measure the quality of graduates' ratios from the faculty and from the university. Thirdly, an indicator to measure the scientific research and inventions. Finally, an indicator to measure the social responsibility.

This raises the following question: who judges education quality? Is it the management, or the lecturers in the university, or the faculty, or the department, or the beneficiary students, or the market, or the society, or an independent board?

For evaluating education or services quality, some research centers distribute questionnaires to lecturers, directors, students, society institutes, or beneficiary organizations. They were asked to give their opinion about the quality of courses, or of faculties, or of the university as a whole. Other researchers tried to measure education quality using one of the following techniques:

- **Expectations technique (from the management perspective): this technique evaluates the education quality using the following formula:**

Education or service quality = Actual performance level - Expectation level (1)

Although this formula appears to be elaborated, but it falls in an estimation gap between two levels (actual and expected) from the perspective of one of the various parties. Therefore, this process is uncontrolled and influenced by personal views, and by the knowledge and interest of those parties. Thus, it does not give correct results about education quality level.

- **Actual performance technique (from the perspective of beneficiaries): it is based on estimating the degree of education quality (without expectations), using the following formula:**

Education or service quality = Actual performance level as estimated by dealers (2)

Although this technique is considered practical and simplified measurement, and supported by important parties in society and market, it suffers from being influenced by personal views, knowledge and interest of dealers in the market and university. Thus, evaluations are biased, or not objective. This is due to that most respondents do not pay their attention to the precise answer, further the questions themselves do not concentrate on the real specifications of the education outputs.

Therefore, for measuring the higher education outcomes quality we have to find other techniques to measure all elements of education outputs, mainly students learning quality from various courses, quality ratios of faculty and university graduates, quality of scientific research, and social responsibility (towards society and environment).

A proposed Technique

To evaluate education outcomes quality we will turn to another technique based on studying and analyzing the marks and ratios gained by students through theoretical and practical examinations. we will try to deduce a quantitative measurement expressed the education quality in each course, each class, and in the faculty as a whole.

Based on preliminary conceptions for students outcomes quality, we define university education quality as follows:

$$\text{Education outcomes quality} = \frac{\text{actual performance level for students}}{\text{possible maximum level}} * 100\% \quad (3)$$

Accordingly, we will search for a suitable mathematical tool to measure this quality.

VI-Frequency Distribution of Students' Degrees

As mentioned above, the maximum degree of the student is 100. If we express the degree by D, then D is a random variable takes its possible values within the range [0,100], and its frequency would be within this range. But the shape of this frequency would be normal, or skewed to the right or to the left. It would also have one peak, or two peaks, or many peaks. In general we can put the actual frequency for students' degrees in the course after classifying it into fifth categories within the total range [0,100] in Table 2 as follows:

Table 2: Students degrees classified into 20 fifth categories:

Number: J	1	2	3	4	5	6	7	8	….	….	17	18	19	20	Sum Σ
Ranges of degrees D	0 −4	5 −9	10 −14	15 −19	20 −24	25 −29	…	…	….	….	80 84	85 89	90 94	95 100	
Frequencies f_j	f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8	…	….	f_{17}	f_{18}	f_{19}	f_{20}	n

However, since the minimum degree for passing is 60%, we propose and believe that the effort of all lecturers, students, and administratio would focus on getting over that minimum level and having a good degree in the course. Thus, we propose that the general shape of the empirical frequency for students' degrees would be skewed to the left and defined by the range [0,100], and would take the shape presented in Figure 1.

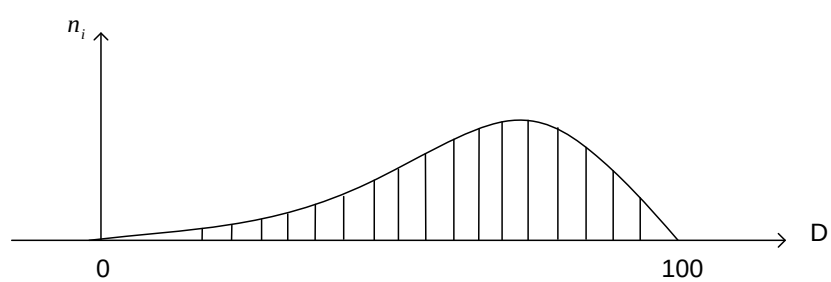


Figure 1: Students' degrees frequency

VII- Most Important Possible quantitative Indicators to Measure Education Outcomes Quality in the Courses and its properties:

It is possible to evaluate the education outcomes quality in courses using many statistical indicators. Before presenting these indicators, some properties should be achieved to express the quality of education outcomes. The most important properties are as follows:

- **The indicator should not depend only on the number or ratio of passing students.**
- **The indicator should be based on the actual degrees of the students.**
- **The indicator should be easy calculated and expresses the real education outcomes quality.**
- **Its possible values should be within the range [0,100].**

- **It should take into account the extreme positions of distribution.**

Indicators that could be used in measuring or evaluating the higher education quality of courses, which is specified by 100 degree, is:

Actual success ratio: it is calculated by the formula:

$$P = \frac{m}{n} 100\% \qquad (4)$$

Where n is the number of students doing the examination, and m is the number of passing students in the course.

We can observe that this ratio does not represent the education quality in courses because it is only based on the number of passing students and the number of students doing the examination. It does not consider the degrees gained by students, or the frequency shape for these degrees. Thus, we do not recommend using it in the evaluation process because it takes a very high value when most of the students pass the exams with low degrees or near 60%.

Median of degrees: it is the value (M_e) which divides the categorized students' degrees into two equal parts. It is calculated using the formula:

$$M_e = \left[D_m + d_m \frac{\frac{n}{2} - k_{m-1}}{n_m}\right]\% \qquad (5)$$

where:
D_m is the minimum boundary to the median range and d_m its long.
n_m is the corresponding frequency to the median range and n is the number of students doing examinations.
K_{m-1} is the ascending aggregated frequencies of the ranges coming before the median range.

Even though this indicator is better than success percentage because it takes into account the frequency shape, however it does not take students' degrees in the calculation. Rather it relies on the number of degrees located on its left and its right. Thus, it portrays a misrepresentation of education quality when most degrees centered in one category.

Median and Two Quartiles: they are defined by the following formula:

$$MQ = \frac{Q_1 + M_e + Q_3}{3} \quad \% \qquad (6)$$

where: Q_1 is the value of the first quartile, and Q_3 is the value of the third quartile.
Again, it does not take into account students' degrees, and it relies on students number located on the left, the right, and the middle. It is better than median indicator and success ratio.

Mean of Students' Degrees: it is expressed by $\bar{D}$, and it is calculated using the following formula:

$$\text{Course Mean} = \frac{\text{Total degrees of students (succeed and failed)}}{\text{Total students number}} * 100$$

$$\overline{D} = \frac{\sum_{i=1}^{n} D_i}{n} 100 = \frac{\sum_{j=1}^{20} f_j \acute{D}_j}{\sum_{j=1}^{20} f_j} 100 \quad (7)$$

Where D_i is the student degree, n is the students number, D_j is the range center j for actual grouped degrees, f_j is the number of frequencies corresponding it, and $\Sigma f_j = n$.

This indicator takes into account all actual degrees gained by both succeed and failed students. It actually expresses the level of students learning gain and the education outcomes quality in the course. It also gives us reasonable picture about the quality of education outputs in this course, provided that all conditions of inputs and processes are convenient and exactly controlled.

Course Degrees Ratio: we will refer to it by R, and we will call it "course ratio". It is calculated by the following formula:

$$\text{Course Ratio} = \frac{\text{Total degrees of students (succeed and failed)}}{\text{Total Maximum Possibility (number of students * 100)}} \times 100$$

If we refer to the student degree i in a course examination as D_i , and to the number of students doing the exam as n, then the course ratio R is calculated for single data or grouped data by the following formula:

$$R = \frac{\sum_{i=1}^{n} D_i}{(100*n)} * 100 \approx \frac{\sum_{j=1}^{20} f_j \acute{D}_j}{(100 \sum f_j)} 100\ \% \quad (8)$$

Where $\grave{D}_j$ is the range center J and f_j is the number of corresponding frequencies for it, and $\Sigma f_j = n$.

We observe here that this indicator totally matches the proposed definition of education outcomes quality in the relationship (3). It actually expresses the learning quality for the students doing the examination through the process of teaching and learning in the course. Thus, we can rely on it for quality evaluation in various courses. On the other hand, this indicator differs in the form and the concept from the general mean defined by the formula (7), but it equals it in the value because:

$$R = \frac{\sum_{i=1}^{n} D_i}{(100*n)} 100 = \frac{\sum_{i=1}^{n} D_i}{n} = \overline{D} \quad (9)$$

Therefore, we found that we can use one of these two indicators (the mean or the ratio) in assessing the quality of courses that have 100 maximum degrees. However, if the maximum degree of the course is not 100, we can replace 100.n by the relevant value. Hence, we can estimate the quality of outcomes in all cases and in all universities.

Outcomes Ratio of Successful Students: we refer to as r_1, it is a special ratio for successful students (who gained 60 and more). It is defined by the formula:

$$\text{Outcomes ratio of successful students} = \frac{\text{Total degrees of Successful Students in the course}}{\text{Total Maximum Possibility for them (their number} \times 100)} \times 100$$

It is calculated for single data or grouped data as follows:

$$r_1 = \frac{\sum_{D_i=60}^{100} D_i}{100 * n_1} 100 = \frac{\sum_{j=12}^{20} f_j \acute{D}_j}{100 \sum f_j} 100\ \% \qquad \textbf{(10)}$$

where D_i is the degree of a successful student i, n_1 is the number of successful students in the course, D_j is the range center j, f_J is the number of corresponding frequencies, and $\Sigma f_j = n$..

As observed, this ratio expresses only the outcomes quality of successful students, but it does not represent the education quality in courses because it does not cover the degrees of failed students.

Outcomes Ratio of Distinguished Students: we refer to as r_2 which is a special ratio for distinguished students (who gained 75 or more). It is defined for single data or grouped data as follows:

$$r_2 = \frac{\sum_{D_i=75}^{100} D_i}{100 * n_2} 100 = \frac{\sum_{j=15}^{20} f_j \acute{D}_j}{100 \sum f_j} 100\ \% \qquad \textbf{(11)}$$

where D_i is the distinguished student degree i, n_2 is the number of distinguished students in the course, D_j is the range center j, f_J is the number of corresponding frequencies, and $\Sigma f_j = n$.

As observed, this ratio expresses the distinction quality, but it does not represent the education quality in the course because it does not include other students doing the examination.

Distinction Ratio: we refer to as p, it is a special ratio expressing the percentage of distinguished students outcomes to the graduated students outcomes. It is defined for single data or grouped data by the following formula:

$$\textbf{Distinction Ratio} = \frac{\textbf{Total Distinguished Students Degrees}}{\textbf{Total Graduated Students Degrees}} \times *100$$

$$p = \frac{\sum_{D_i=75}^{100} D_i}{\sum_{D_i=60}^{100} D_i} 100 = \frac{n_2 * r_2}{n_1 * r_1} 100\% \quad (12)$$

We observe that this percentage expresses the degree of distinguished students within the successful students in the course, but it does not represent the education quality in the course, because it does not take into account all the students doing the examination. However, it would be useful in estimating the quality of distinguished students from the successful students or the graduated students, as we will see later.

<u>First Application: the results of the unified medical examination for year 2013 (typical course):</u>

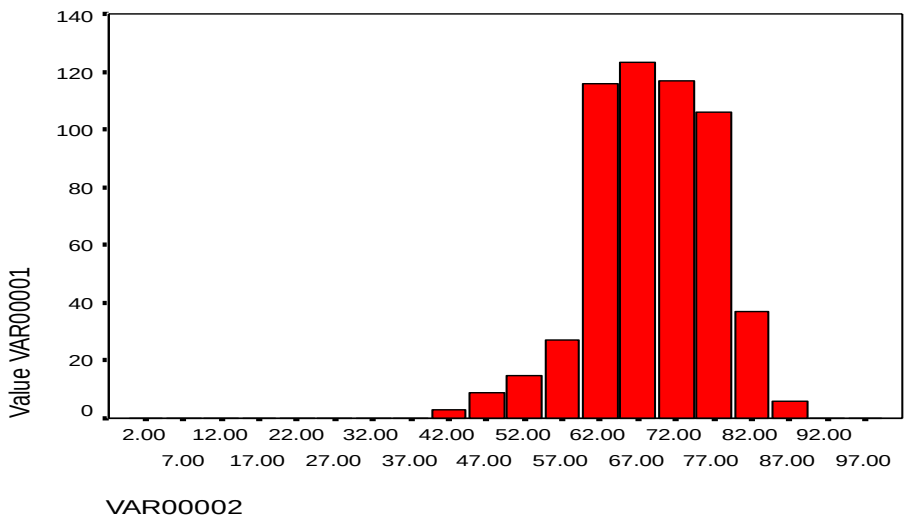
The Ministry of Higher Education administers a yearly unified examination for graduated students from medical faculties in the private and public Syrian universities. Graduated students from other countries participate also in it. The results of this examination are used to evaluate the education quality in medical faculties. We will apply and test the indicators mentioned above on the results of the unified medical examination for 2013 to assess its validity as a measurement for university teaching quality in medical faculties.

According to the published data on the web site of the Ministry of Higher Education for 2013 (after excluding the hidden results due to noncomplete documents), the results are as follows:
Number of students doing the examination: 560
Number of successful students: 506 (success degree is 60 or more)
Number of failed students: 54
Actual success ratio = 90.30%. It indicates an excellent quality!!!!!
Grouped data for the degrees gained by these students within categories of fifth ranges is presented in Table 3, and The frequent histogram is shown in Figure 2.

Table 3: Distribution of Students degrees in the unified medical examination for 2013

No. J	Range	Corresponding Frequencies f_i	Ranges Centers D_i	Multiplications $F_j D_j$	No. J	Range	Corresponding Frequencies f_i	Ranges Centers D_i	Multiplications $F_i D_i$
1	0-4	0	2	0	11	50-54	15	52	780
2	5-9	0	7	0	12	55-59	27	57	1539
3	10-14	0	12	0	13	60-64	116	62	7192
4	15-19	0	17	0	14	65-69	123	67	8241
5	20-24	0	22	0	15	70-74	117	72	8424
6	25-29	0	27	0	16	75-79	106	77	8162
7	30-34	0	32	0	17	80-84	37	82	3116
8	35-39	0	37	0	18	85-89	6	87	522
9	40-44	3	42	126	19	90-94	0	92	0
10	45-49	9	47	423	20	95-100	0	97.5	0
General total							560		38525
Total of Successful Students (+ 60)							506		35657
Total of distinguished Students (+ 75)							149		11800

Figure 2: frequent histogram of the unified medical examination results for 2013



Based on data presented in table 3, we calculated the indicators values, and found the following:

Actual success ratio: $P = \frac{m}{n} = \frac{506}{560} * 100 = 90.36\ \%$

This indicates that the quality of education in medical faculties is excellent!! But this ratio is not valid for measuring education quality, because it is only based on the number of successful students, and it ignores their degrees in the examination.

Median: it is located in the third range, and it is calculated by the formula (5) as follows:

$$M_e = \left[65 + 5 * \frac{\frac{560}{2} - 170}{123}\right] = [65 + 4.47] = 69.47\ \%$$

This indicates that the education quality is moderate in spite of the success ratio equals 90.30%. However, this indicator is limited by ignoring the actual degrees and considering only their distribution on the right and the left.

Median and Quartiles: we calculate it using the formula (6):

$$MQ = \frac{Q_1 + M_e + Q_3}{3} = \frac{63.7 + 69.47 + 75.198}{3} = 69.456$$

It has a moderate value, but it does not consider students' degrees.

Course Mean of students' degrees: it is calculated using the data in table 3 and the formula (7) as follows:

$$\bar{D} = \frac{\sum f_j \grave{D}_j}{\sum f_j} = \frac{38525}{560} = 68.79\ \%$$

It indicates that the average outcomes of students equals 68.79 degree from 100 degree. This means that the education quality is moderate. It seems that this value indeed expresses the quality, because it considers all the actual degrees of successful and failed students, and reflects the quality of education outcomes of students in that examination. Thus, it gives us a reasonable picture about the outputs quality of higher education in that examination, although it is very different from success ratio (90.36%).

Course Ratio: it is calculated using the formula (8), and from the data presented in table (6):

$$R = \frac{\sum^{20} f_j \acute{D}_j}{100 * n} 100 = \frac{38525}{100 * 560} 100 = 68.79\ \%$$

It gives us the same value of the median and the same average estimation for education quality, and it reflects the percentage of the overall outcomes in that examination. It also expresses the education quality in medical faculties.

Outcomes Ratio of Successful Students. It is calculated using the formula (10) and the data presented in table (3):

$$r_1 = \frac{\sum f_j \acute{D}_j}{100 \sum f_j} 100 = \frac{35657}{506} 100 = 70.47\ \ \%$$

It means that successful students had a good ratio in this examination. However, using successful students ratio without including failed students for estimating the education quality gives us a biased picture.

Outcomes Ratio of Distinguished Students: it is calculated using the formula (11) and the data presented in table (3):

$$r_2 = \frac{\sum f_j \acute{D}_j}{100 \sum f_j} 100 = \frac{11800}{100 * 149} 100 = 79.19\ \ \%$$

It is a good value.

Distinction Ratio: it is calculated using the formula (12) and the data presented in table (3):

$$p = \frac{n_2 * r_2}{n_1 * r_2} 100 = \frac{149(79.19)}{506(70.47)} 100 = 33.09\%$$

VIII- Possible Indicators for Evaluating Education Quality in the Faculty

1- Definition of higher education quality ratio in the faculty

For defining this quality ratio, we must determine the time when we calculate the indicators, and determine also the courses that we rely on in the definition. Therefore, we need the following operatioal definitions:

- **The quality of education should be calculated at the end of each semester, whether the first semester or the second semester.**
- **The courses used in calculating the quality are the basic courses in that semester, without admitting other courses from other semesters.**

- **If there is a third examination period, the quality is calculated based on the results of all courses.**

For defining education quality ratio in the faculty, we will use courses ratios that we adopted in education quality evaluation for courses. Based on formula (3), we can conclude a definition for education quality ratio in the faculty at the end of each semester as follows:

$$\textbf{education quality ratio in the faculty (at the end of semester)} = \frac{\textbf{total students' degrees in all basic courses in a semester}}{\textbf{total maximum possibility of students making the examination of basic courses}} \times 100 \qquad (13)$$

It is noticeable that quality ratio in the faculty differs from courses ratios average because these courses vary according to the number of students making the exams. We will deal with this issue for classes, majors, and the faculty.

Notice: this ratio can be calculated using the formula (13) directly and taking the total of students' degrees for all basic courses in the semester and in all classes and all majors, and then dividing it by the total maximum possibility for them (the total number of students doing the exam × 100). However, it is better to calculate this ratio using the classes and majors to make the assessment and evaluation process easier. Accordingly, we will follow the next procedure.

2- Calculating education quality in classes

Let's suppose that we need to calculate this ratio in one class (common branch or major), and let's suppose that the number of basic course in that class during the semester is M courses.

The number of students doing the course examination k is n_k: (k: 1, 2, 3, 4…..m)

The student degree i in the course examination k is D_{ik}: (i: 1, 2, 3, 4……, n_k)

The total of students' degrees (successful and failed students) in the course k is S_k: ($S_k=\sum_{i=1}^{nk} D_{ik}$)

The general ratio of students' degrees in the course k is R_k (successful and failed students).

From the formula (8) which focuses on courses ratios, we found that the ratio of course K equals R_k, and it is calculated using the formula:

$$R_k = \frac{\sum_{i=1}^{n_k} D_{ik}}{100 n_k} 100 = \frac{S_k}{100 n_k} 100 \qquad \textbf{(14)}$$

Based on the formula above, we found that the total of students' degrees in the course K equals:

$$S_k = \sum_{i=1}^{n_k} D_{ik} = n_k * R_k$$

Based on (14), we also found that the total of students' degrees (successful and failed students) in all basic courses in a specific semester equals:

$$\sum_{k=1}^{M} S_k = \sum_{k=1}^{M} \sum_{i=1}^{n_k} D_{ik} = \sum_{k=1}^{M} n_k * R_k$$

The total number of students doing the exam in that class during that semester equals:

$$\sum_{k=1}^{M} n_k = N$$

The total maximum possibility for these students equals:

$$100 \sum_{k=1}^{M} n_k = 100 * N$$

Based on that definition presented in formula (13), we can establish a quantitative indicator $\bar{R}$ for higher education quality in that class at the end of specific semester using the following formula:

$$\bar{R} = \frac{\sum_{k=1}^{M}\sum_{i=1}^{n_k} D_{ik}}{100\sum n_k}100 = \frac{\sum_{k=1}^{M} S_k}{100*N}100 = \frac{\sum_{k=1}^{M} n_k R_k}{100\sum n_k}100\,\% \qquad \textbf{(15)}$$

where: n is the total number of students doing the exams of basic courses in that class during that specific semester.

The formula (15) gives us a quantitative indicator for measuring education quality in a specific class. This definition is in agreement with the general definition presented in formula (3). Applying this formula on all classes, we get a special ratio for each class, and accordingly for each major in the given faculty. These ratios present a correct scientific base for evaluating education quality in each class, and help the administratio evaluate the education operatio.

3- Calculating education quality ratio in the faculty:

After calculating class ratios $\bar{R}$, we suppose that the number of classes (common classes and majors) is H class. We give the class ratio ℓ the symbol Rℓ where (ℓ: 123 …H), and we will give the total degrees of students in all basic courses in class ℓ the symbol G_ℓ, then we will find:

$$G_\ell = \sum_{k=1}^{M} S_{k\ell}$$

We will give the total number of students doing the exams of the basic courses in the class e the symbol N_ℓ . Then the formula (15) will take the following formula:

$$\bar{R}_\ell = \frac{G_\ell}{100N_\ell}100$$

Based on the above formula, we find:

$$G_\ell = N_\ell * \bar{R}_\ell$$

Let's suppose that G is the total students' degrees in the basic courses in all classes; it equals:

$$G = \sum_{\ell=1}^{H} G_\ell$$

Let's also suppose that T is the total number of students doing the exams of basic courses in all classes, it equals:

$$T = \sum_{\ell=1}^{H} N_\ell$$

We found that the total maximum possibility for these students equals:

$$100\sum_{\ell=1}^{H} N_\ell = 100 * T$$

Therefore, we can define a quantitative indicator for evaluating the higher education quality of the faculty as a whole using the following formula:

$$Q = \frac{G}{100*T}100 = \frac{\sum_{\ell=1}^{H} G_\ell}{100\sum N_\ell}100 = \frac{\sum_{\ell=1}^{H} N_\ell * \bar{R}_\ell}{100\sum_{\ell=1}^{H} N_\ell}100\,\% \qquad \textbf{(16)}$$

Where: G is the total students' degrees in all basic courses and majors in that semester, and T is the total number of the students doing exams of that basic courses. We can apply the formula (16) by using the total of multiplications of classes ratios $\bar{R}_\ell$ multiplied by the number of students doing the exams in the classes N_ℓ , then dividing the product by the maximum possibility for them (100 Σ N_ℓ).

To sum up, this relationship gives us a quantitative indicator which really express education quality in the faculty as a whole. It also measures the students' learning gain in all courses in a specific semester at the end of a given examination period.

Notice: if the administratio desires to calculate the quality of all courses for the whole year, it can consider all the periods as a one period, and considers all the repeated courses as independent courses, so the number of courses equal to the total number of the courses in these periods. As well as it can integrate the results of each course from various periods in a one list, where the number of students doing the exam of course K is the total number of students in those periods, and their results are the degrees D_{ik} presented in the unified list. Based on it, we calculate the general ratio in all periods, then calculate the general ratio in the faculty.

Second Application: calculating the higher education quality ratio in the faculty of Economics at Tishreen University in Lattakia at the end of second semester for the academic year 2013-2014.

The examination department in the Faculty of Economics provided us with students' results during the second semester for the academic year 2013-2014 based on a tabulation form which we classified the results according to the courses and classes (years) and majors. It also includes the number of students n_k , and the total of their degrees S_k in the exams of basic courses taught during the second semester for the year 2013-2014. Reading and studying the courses ratios presented in the table enable us to evaluate the education quality. Then we calculate the totals and the courses ratios and present them in the last column. By studying them, we can evaluate the education quality in each class, and in each major.

For calculating the higher education quality in the Faculty of Economics as a whole, we transferred the last column data and ordered it based on the classes as shown in Table 4.
Table 4: Numbers, Totals, and Classes Ratios in the Faculty of Economics

No. ℓ	Class	Total number of students doing exams N_ℓ	Total students' degrees in basic courses G_ℓ	Classes ratios % by (15)
1	First year	5136	269905	52.55%
2	Second year	4674	228482	48.88%
-----	Third year	-----	-----	-----
3	Accounting	1289	78262	60.72%
4	Management	502	33891	67.51%
5	Banking	698	46553	66.69%
6	Economics	90	4293	47.70%
7	Statistics	33	1723	52.21%
-----	Fourth year	-----	-----	-----
8	Accounting	909	46429	51.09%
9	Management	344	24003	69.32%
10	Banking	614	23659	38.53%
11	Economics	60	4223	70.38%
12	Statistics	26	2105	80.96%
	Total	14375 = T	763528 = G	53.15%

Source: Examination Department in the Faculty of Economics at Tishreen University

By studying the table, we observe that education quality ratios differ between classes, and between majors. It ranges from 47.705 % to 80.96%. For calculating education quality ratio in the faculty as a whole, we apply the formula (16), and find that:

$$Q = \frac{G}{100T}100 = \frac{\sum G_\ell}{100\sum N_\ell}100 = \frac{76763528}{100(14375)}100 = 53.15\,\%$$

This means that education quality in the Faculty of Economics during the second semester for year 2013-2014 was 53.15%. This means that it is only at an accepted level. It is due probably to the crisis in Syria in the present time.

X- Quality of Education Outputs

To define these ratios we follow the same procedure, and we abbreviate them as follows:

1- Graduation quality ratio: it is a special ratio expresses the graduated students' learning quality from the faculty (or department) at the end of each year. It is calculated in a way similar to the quality of successful students in the course with some modifications in the names and meanings as follows:

$$\text{Graduation Quality Ratio} = \frac{\text{Total Rates of Graduated Students from the Faculty at the End of the Year}}{\text{Total Maximum Possibility for them (their total} \times 100)} \times 100 \qquad (17)$$

The graduation rate for each student is calculated from the following relationship:

$$\text{Graduation Rate of Student} = \frac{\text{total degrees of student in all courses in the faculty}}{\text{number of courses}} \times 100 \qquad (18)$$

To formulate that ratio mathematically, we suppose that the number of graduated students is N, and the graduated student rate i is r_i , and the number of courses in the faculty (or department) equals L courses. As mentioned above, we found that the student rate r_i equals:

$$r_i = \frac{\sum_{k=1}^{L} D_{ik}}{100L} 100 \qquad (19)$$

Based on it, we found that the graduated students quality ratio, referred as to Q_1, is calculated when the rates are single or grouped by the formula as follows:

$$Q_1 = \frac{\sum_{i=1}^{N} r_i}{100 * N} * 100 = \frac{\sum_{j=1}^{8} f_j * \grave{r}_j}{100 \sum_{j=1}^{8} f_j} 100\ \% \qquad (20)$$

where: $\grave{r}_j$ is the range center j. We can observe that the ratio Q_1 really represents the graduated outcomes quality.

Distinguished students' quality ratio: calculating this ratio gives us an idea about the distinguishing degree within the graduated students' degrees. We define it using a relationship similar to the relationship presented by the formula (20) as follows:

$$\text{Distinction quality ratio} = \frac{\text{total rates of distinguished graduates at the end of the year}}{\text{total maximum possibility for them (their number} \times 100)} \times 100 \qquad (21)$$

We suppose that the number of distinguished graduates is H, and the rate of distinguished graduate X (who has 75 or more) is r_x. As mentioned above, distinction quality ratio, referred to as Q_2, is calculated for single or grouped rates as follows:

$$Q_2 = \frac{\sum_{x=1}^{H} r_x}{100 * H} 100 = \frac{\sum_{j=4}^{8} f_j * \grave{r}_j}{100 \sum_{j=4}^{8} f_j} 100\ \% \qquad (22)$$

We observe that the ratio Q_2 really represents the distinguished graduates' outcomes quality.

Distinction Ratio: it is the percentage of distinguished students' outcomes to the graduates' outcomes, which we refer to as P, and it equals:

$$\text{Distinction ratio} = \frac{\text{total rates of excellent students}}{\text{total rates of graduated students}} \times 100 \qquad (23)$$

Calculating this ratio gives us an idea about the distinction degree between the graduates in the faculty.

Third application: calculating the graduates quality in the Faculty of Economics at Tishreen University at the end of the academic year 2013-2014

We were provided, by the examination department, by the number and the rates of the graduates according to the majors in the various departments. Grouped data within ranges was shown in Table 5.

Table 5: frequent distribution of graduates' ratios for the academic year 2013-2014 according to the departments

No. J	Range of rates	Majors						Total
		Range Center	Accounting Department	Banking Department	Management Department	Economics Department	Statistics Departments	
1	60-65	62.5	3	2	1	5	1	12
2	65-70	67.5	37	28	18	9	1	93
3	70-75	72.5	37	27	16	1	2	83
4	75-80	77.5	14	6	7	3	3	33
5	80-85	82.5	3	2	2	0	0	7
6	85-90	87.5	1	1	0	0	0	2
7	90-95	92.5	0	0	0	0	0	0
8	95-100	97.5	0	0	0	0	0	0
	Total graduates/total distinguished students	----	95/18	66/9	44/9	18/3	7/3	230/42
	Product=$\Sigma f_i r_i$ of graduates/of distinguished students	----	6787.5 1420	4690 717.5	3145 707.5	1225 232.5	507.5 232.5	16355 3310
	Education quality ratio in departments	----	71.45	71.06	71.48	68.06	72.5	71.11
	education quality ratio of distinguished students	----	78.89	79.72	78.61	77.5	77.5	78.81
	Distinction Ratio	----	20.92	15.3	22.5	18.98	45.81	20.24

Source: examination department in the Faculty of Economics

As mentioned above, the total of graduates was 230 students, and they were distributed in five departments. Their education quality ratios at each department are calculated using

the formula (20). For calculating the overall education quality for these graduates, we apply formula (20) using the data presented in the last column. We found that:

$$Q_1 = \frac{\sum f_i \acute{r}_i}{100 \sum f_i} 100 = \frac{16355}{100 * 230} 100 = 71.11\%$$

For calculating education quality of distinguished students, we apply formula (22), and found that:

$$Q_2 = \frac{\sum^8 f_j r_j}{100 \sum_{j=4} f_j} 100 = \frac{3310}{100 * 42} 100 = 78.81\%$$

For calculating the distinction ratio, we apply formula (23), and we found that:

$$P = \frac{H * Q_2}{N * Q_1} 100 = \frac{42(78.81)}{230(71.11)} 100 = 20.24\%$$

XI-Results

As mentioned previously, we were able to find specific quantitative methods for measuring education quality in the faculties at universities. However, these measurements vary in content and value, and in the representation of quality. After excluding the measures that do not consider the students' outcomes (such as success ratio, median, and composed median), we classified our accepted measures in this research into three levels as follows:

First Level: education quality measures in courses: we suggest using one of the following two measures, which are based on students' degrees in the courses:

1- **Students' degrees mean (successful and failed students): it is defined by the following relationship:**

$$\text{Course mean} = \frac{\text{total of students' degrees}}{\text{total number of students}}$$

It is calculated for single or grouped degrees using the following relationship:

$$\bar{D} = \frac{\sum^{n} D_i}{n} = \frac{\sum_{i=1}^{m} f_j \acute{D}_j}{\sum f_j} \ \% \qquad \text{where: } \Sigma f_j = n \qquad (24)$$

It gives us an objective value about the education qualiy of students in the course.

2- **Ratio of students' degrees (successful and failed students): it s defined by the following relationship:**

$$R = \frac{\sum^{n} D_i}{100*n} 100 = \frac{\sum f_j \acute{D}_j}{100 \sum f_j} 100 \ \% \qquad \text{where: } \Sigma f_j = n \qquad (25)$$

It gives us an objective value about the education quality of students in that course. Although its value equals the value of the previous mean, but it differs in that its definition agrees with the proposed model in formula (3), and it meets the conditions mentioned in the introduction. This ratio also represents education quality level in courses, that's why we recommend to use it as a quantitative measure of education quality in courses.

Second Level: education quality measures in faculties: we suggest using the measure defined by formula (15), which based on the general ratios of the courses taught during a specific semester (or year) as follows:

$$\bar{R} = \frac{\sum^{M} \sum^{n_k} D_{ik}}{100 \sum n_k} 100 = \frac{\sum^{M} n_k * R_k}{100 \sum n_k} 100 \qquad (26)$$

It is also possible to use the general average instead of the general ratio R_k and calculate $\bar{D}_k$ from the following formula:

$$\bar{R} = \frac{\sum \sum D_{ik}}{100 \sum n_k} 100 = \frac{\sum_{k=1}^{n} n_k * \bar{D}_k}{100 \sum n_k} 100 \qquad (27)$$

Third Level: education outputs quality measures: we suggest using the following measures:

1- **Graduation Quality Ratio: it is calculated from formula (20) as follows:**

$$Q_1 = \frac{\sum_{j=1}^{N} r_i}{100*N} 100 = \frac{\sum_{j=1}^{s} f_j \acute{r}_j}{100 \sum f_j} 100 \qquad (28)$$

where N: number of graduates, $\Sigma f_j = N$, and r_i is the rate of a graduated student i.

2- **Distinguished students' quality ratio (75 or more): it is calculated by formula (22) as follows:**

$$Q_2 = \frac{\sum_{x=1}^{N} r_x}{100*H} 100 = \frac{\sum f_j \acute{r}_j}{100 \sum f_j} 100 \qquad (29)$$

where H: number of distinguished students, and r_x is the rate of a distinguished student x.
Distinction ratio: it is calculated by formula (23) as follows:

$$P = \frac{\sum_{x=1}^{H} r_x}{\sum_{i=1}^{N} r_i} 100 = \frac{H*Q_2}{N*Q_1} 100 \qquad (30)$$

In conclusion, educational institutions that truly believe in the quality of their services make strong commitments to their students (outcomes). They address the principal concerns of students, eliminate conditions that might weaken their trust and confidence and communicate clearly and simply to them. **However, these indicators do not express education quality in the faculty because it does not consider the non-graduated students, and its meaning is limited to the education outputs quality.**

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