EVALUATION AND GRADING: DO TEACHING ENGINEERS KNOW THE DIFFERENCE?*

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ABSTRACT

Being a teaching engineer implies many challenges, and one of them involves understanding clearly the difference between grading and evaluating, for they are the end of a learning process used to validate, verify, and give feedback. One may think that grading and evaluation are two ways to see what students have learned. This article presents the results of research conducted with teaching engineers to study their idea of grading vs evaluating and verify how they specifically see the difference. The methodology of the study was to interview a sample of teaching engineers from universities in a specific geographical area. The study worked a qualitative approach although quantifications were used to facilitate analyses. The technique implemented was a structured interview with quantifiable open questions. The results indicate that teaching engineers have some ideas regarding this matter, yet they do not coincide with the theoretical aspects of teaching. Finally, it is fundamental to strengthen engineering teaching for teaching engineers.

Keywords. Learning, Grading, Teaching, Assessment, Engineering

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EVALUACIÓN Y CALIFICACIÓN: ¿CONOCEN LA DIFERENCIA LOS INGENIEROS DOCENTES?

RESUMEN

Ser un ingeniero docente implica muchos desafíos, y uno de ellos consiste en comprender claramente la diferencia entre calificar y evaluar, ya que ambas representan el final de un proceso de aprendizaje utilizado para validar, verificar y retroalimentar. Podría pensarse que calificar y evaluar son dos formas de observar lo que los estudiantes han aprendido. Este artículo presenta los resultados de una investigación realizada con ingenieros docentes para estudiar su concepción sobre calificar versus evaluar y verificar cómo perciben específicamente la diferencia. La metodología del estudio consistió en entrevistar a una muestra de ingenieros docentes de universidades en una zona geográfica específica. El estudio adoptó un enfoque cualitativo, aunque se utilizaron cuantificaciones para facilitar los análisis. La técnica implementada fue una entrevista estructurada con preguntas abiertas cuantificables. Los resultados indican que los ingenieros docentes tienen algunas ideas al respecto, aunque estas no coinciden con los aspectos teóricos de la enseñanza. Finalmente, es fundamental fortalecer la enseñanza de la ingeniería para los ingenieros docentes.

Palabras clave. Aprendizaje, calificación, enseñanza, evaluación, ingeniería.

INTRODUCTION

Strengthening teaching profiles just like their disciplinary profile is one of the great challenges that teaching engineers must overcome. They are professionals trained in engineering programs but have taken up teaching as their professional and work development [1]. Knowledge validation and feedback on a course are part of the different stages of a formative process. For some professors, it is grading, and for others evaluating [2]. This dichotomy is part of what a professor must comprehend because this stage validates three purposes that only they can fulfill. They are a) verifying students' learned knowledge and their ability to implement it, b) validating students' following-level continuity, and c) becoming an example of justice and equality as society's basic principles [3].

Hence, this research problem consists of attaining an approach required to determine to what extent teaching engineers are engineers and teachers. That is, how far the two strong edges on which their profiles are based are sufficiently grounded so that disciplinary knowledge supports the actions, strategies, and ways they teach their courses in such a way that together they may allow students to assimilate and implement new knowledge and link it with previous knowledge [4]. Taken from a sample in a defined geographical área, the purpose of the study is based on approaching qualitatively and quantitatively the idea that teaching engineers have about the difference between evaluating and grading and carrying out respective derived analyses.

The objective of this article is to present the results obtained in an inquiry using interviews as a mechanism to gather information for six academic semesters in which teaching engineers in the Eje Cafetero region were asked about their experience concerning what it is to evaluate and grade in engineering courses of different engineering programs. Likewise, the study generates some considerations, brings about discussions, and reaches conclusions inviting teaching engineers' reflections.

The novelty of this article can be framed into four aspects. a) This study is education research conducted by Educational Science PhD teaching engineers [5]. b) It has been developed based on a sample of only teaching engineers. c) It questions these teaching engineers' ideas about the difference between grading and evaluating, and d) this study criticizes some aspects of the issue and proposes solutions to what is considered necessary in today's society [6]. The article is justified because teaching engineers' profiles permeate society, and they have begun to fill spaces that before were only for pedagogically trained professors. Although there is much that engineering can contribute to students [7], it cannot be denied that pedagogical training complements the work of any professional who wants, as in this case, to teach professionally [8].

The article goes as far as the analytical and critical review of the results as well as proposing concrete actions to strengthen the evaluation above the grade by the teaching engineers. As a conceptual framework, the content of the article is based on the theories: meaningful learning [8] [9], assessment, competency-based training [10] [11], learning by discovery [12] [13], connectivism [14] [15] and invisible learning [15].

The information was gathered from teaching engineers at universities located in the Eje Cafetero region from the first semester of 2020 to the first semester of 2023. The article was structured based on IMRYD standard [16] [17] proposing an introduction, presenting the methodology with the results, opening an analytical discussion, and generating conclusions and recommendations. As a hypothesis, the study proposes that it will be much more enriching and motivating for students if their teaching engineers privilege evaluation over grading since the latter is much more objective, pedagogical, and academic.

METHODOLOGY

For this article, researchers carried out a qualitative interaction approach with teaching engineers based on a structured interview as a basis to gather information. They selected 60 teaching engineers at universities located in a geographic center of Colombia known as the Coffee Axis (Eje Cafertero) and adopted a structured interview technique with qualitative assessment and open answers to target the research object. Researchers analyzed responses resorting to semantic analysis and intertextual analysis based on similarity of meaning. The names of the universities where the interviewees worked were omitted upon their request. The study asked the following questions:

1. Question 1. Do you know the difference between evaluating and grading?
2. Question 2. Can you explain the difference between evaluating and grading?
3. Question 3. Do you evaluate or simply grade?
4. Question 4. Are your midterm knowledge tests intended to evaluate or grade?
5. Question 5. Can you show us a written review?

Interviews were conducted in informal settings in a setting of dialogue and fluent conversation, which, at times, implied more time than planned. The subjects were interviewed from the first semester of 2020 to the first semester of 2023 at the universities where the professors worked. All the information-gathering process was conducted with a qualitative approach. It allowed researchers to see it surpasses a quantitative approach that enables a description of a phenomenon. Some quantifiers

that reinforce the comprehension of a qualitative approach were not discarded. We always met with teaching engineers at the times, schedules, and places suitable to them because this factor was considered important for result reliability and objectivity. Researchers accepted Google Meeting and WhatsApp Video interviews as a result of constraints beyond the researchers' control, like restrictions resulting from the health situation at that time.

The information was recorded verbatim according to the answers, and professors were always allowed to complement them with comments and opinions in this regard, they were recorded as accurately as possible, adjusting to what interviewees uttered. Researchers organized information according to contextual similarities and applied a semantic analysis technique with intertextual bonds to interpret, approximate, and analyze the texts representing collected information. Each interview lasted about an hour although some took a little longer because the conversation was very interesting for teaching engineers or because professors, voluntarily, took the time they required to expand their answers. In brief, teaching engineers expanded their answers voluntarily and freely.

RESULTS

First, this study elucidates some methodological explanations made in this section considered relevant to a point, and they refer to the specific results obtained and presented in each table. Although they may be part of a methodology, researchers considered it appropriate to include them in this section because they correspond to specific details that make sense together with their corresponding tables.

Table 1 depicts interviewee quantification by age range. It is important to bear in mind that the intention was to have a multicolored panorama of the opinions since, as will be described in the study's Analysis of Results, the opinions of different age groups enrich research perspectives and allow them to know professors' stand based on their experiential chronological perspective.

Table 1. Interviewees' Age Profile

Age Range	Q
Under 30	15
31 to 40 year-olds	20
41 to 50 year-olds	15
Over 51	10
TOTAL	60

Source: Authors' compilation

Table 2 shows interviewee quantification based on experience as engineering professors. This factor will be analyzed in the Results Analysis section because it is a direct strong link with the data in Table 1 and strengthens professors' perception not from experiential chronology but from their time on the job which, in itself, imprints a dynamic different from data derived from age.

Table 2. Interviewees' Experience Profile

Years of Experience	Q
Less than 10 years	10
From 11 to 25 years	30
More than 25 years	10
TOTAL	60

Source: Authors' compilation

Interviewees' academic training also imprints a series of criteria on the interview, since the awareness they acquire about the importance of establishing the difference that inspires the title of this article depends to a large extent on this level. Table 3 presents interviewee quantification according to the highest level of academic training obtained at the time of the interviews. It should be noted that in Table 1, Table 2, and Table 3, the data are those resulting at the time the information was collected, which was done during a research window from the first semester of 2020 to the first semester of 2023. At present, the data in these tables may have changed according to advances in each of these topics.

Table 3. Interviewees' Training Profile

Training Level	Q
Specialization	15
Master's Degree	35
Doctorate	10
TOTAL	60

Source: Authors' compilation

Table 4 presents a quantitative perspective of interviewees answers. In this case, the answers of the teaching engineers were analyzed as affirmative or negative, depending on the meaning of the question.

Table 4. Quantification of some responses

Prg	Statement	Yes	No
1	Do you know the difference between evaluating and grading?	11	49
2	Can you explain the difference between evaluating and grading?	8	52
3	Do you evaluate or simply grade?	Eval	11
		Calif	49
4	Are your knowledge mid-term tests intended to evaluate or to grade?	Eval	14
		Calif	46
5	Can you show us a written evaluation?	38	22

Source: Authors' compilation

Like the questions of the teaching engineers' interview, Table 5 presents the result of a selection of the answers that approximate or interpret the meaning of the others according to the application of intertextual analysis and semantic analysis techniques.

Table 5. Interviewees' Answer Selection

Prg	Statement	Remarks
1	Do you know the difference between evaluating and grading?	• They are practically the same • It's an education thing, I'm an engineering person • I don't know the difference • For me, deep down, they are the same • Grading is easier than evaluating
2	Can you explain the difference between evaluating and grading?	• I understand it but I cannot explain it • Explaining it is for experts • These are Education matters not Engineering • It is not easy to explain
3	Do you evaluate or just grade?	• I think I always evaluate. • I think I just grade • It's the same thing (sic) • I don't worry about that • That's not important
4	Are your midterm knowledge tests intended to evaluate or grade?	• I aim to evaluate • Actually, what I do is grade. • I don't even know if I'm grading well, that is, fairly. • I grade to know who passes and who does not. • I believe in grading as a form of evaluation
5	Can you show us a written evaluation?	• Here • I don't usually show my evaluations • That corresponds to academic freedom • My pleasure

Source: Authors' compilation

RESULTS ANALYSIS AND DISCUSSION

Table 1 presents interviewee quantification classified by age, showing that the largest number is in the 31-40-year-old range. Notice that the selection was not biased, that is, professors were randomly selected based on various reasons related to their professional, personal, or academic ties with the authors. The table in some way reflects a reality lived at Colombian universities (without saying that this is a conclusive study) where there is a generational change and most of the current professors are 31 to 50-year-olds.

In this sense, notice that since the professors are relatively young they have a moderate relationship with technology because they were born when it was just emerging or when it was beginning to be in all social spheres. This means that technology is not part of their natural language and therefore they were trained with traditional methods without it. This leads us to think that the idea these teaching engineers may have of the difference between evaluation and grading is a result of their experience and not their training because of the relationship they have had academically with evaluation systems.

Engineers under 30 have already had contact with different teaching approaches in terms of training and information, and they can distinguish the difference between evaluating and grading more than others. On the other hand, teaching engineers over 51 are people who give little relevance to the difference inspired by this article, and therefore, from their training and their own experiences, they see grading and evaluation as synonyms without going into differentiating them.

Regarding teaching experience, Table 2 presents a quantification with the most answers found in the 11-25-year experience range. They are professors who have had contact with training and questioning teaching work processes and the advanced work that universities have implemented to train their professors in theories and models that promote more effective efficient learning. Teachers with less than 10 years of experience have been trained in those models, and therefore, it will be much easier for them in the future to take on the challenge of establishing the difference between evaluation and grading. Teachers with more than 25 years of experience were trained in times when the knowledge validation process was oriented to grading and as a result of their personal and academic experience, have not been permeated (except in very exceptional cases) by new training trends, models and theories that give student knowledge and formative work assessment more importance than grading.

Regarding interviewees' educational level, Table 3 shows most were Master's degree holders and almost the same number of Specialization and Doctorate holders. Notice that many interviewees with a Master's degree are in doctoral training, which indicates that any of the three tables (Table 1, Table 2, or Table 3) may have different

results depending on when they are compiled since the trend is for professors to be trained at doctoral levels, and this has become the goal of higher education institutions. The concentration of teaching engineers with a Master's degree indicates the possible academic approach they may experience regarding new models, theories, and educational trends that may allow them to see and apprehend the difference between evaluation and grading better.

Table 4 presents some quantitative results that should be analyzed separately because of their intimate relationship with the purpose of this research. Question 1 shows that more than 80% of the teaching engineers interviewed accepted that they did not know the difference between evaluation and grading. Only 11% accepted that they did know the difference. However, when asked if they could explain it, the percentage increased, since 87% of the respondents were unable to explain the difference compared to 13% who said they could. This indicates that the first question is less compromising than the second, and therefore the percentage reveals the underlying reality of both answers.

Question 3, which asks whether a teaching engineer evaluates or grades, shows that 11 of the interviewees evaluate, while 40 (81%) grade suggests that the difference is not clear and therefore they use what they know and is easier, such as grading instead of evaluating. Also, it implies a series of additional activities and quantitative and qualitative evaluations that highlight and enhance a student's work. Likewise, this question confirms teaching engineers do not know the difference between evaluating and grading.

When they were asked whether knowledge tests had the purpose of evaluating or grading, the question was asked regarding their approach to designing those tests. Notice that all the professors' questions were filled out including an explanation that allowed greater clarity regarding test purposes. The answers to question 4 reveal that 14 (24%) professors use an evaluative approach in their midterm tests and 46 (76%) teachers do it from a purely qualitative perspective.

Question 5 showed that some of the answers did not coincide with reality, otherwise, it is difficult to explain why, when asked to show a written evaluation in order to verify their answers, only 38 (63%) of the teaching engineers did so diligently and immediately, while 22 (37%) gave an excuse for not doing so without explicitly refusing to do so, but giving evasive arguments that made their refusal clear.

About the qualitative information in Table 5, the selected responses, which synthesize others' spirit, contain a set of phrases that confirm the quantitative results presented in Table 4 and, especially, what can be inferred from question 5:

- Question 1. Do you know the difference between evaluating and grading?

These answers reflect a situation that, although normal, is interesting in the sense of the research conducted, and which has to do with teaching engineers' lack of knowledge regarding the difference between evaluating and grading as elements that dynamize the quantification of what has been learned in qualitative terms (when speaking of evaluation) and in quantitative terms (when speaking of grading). For teaching engineers, these two terms are "practically the same", which represents a mistaken comparison from the teaching perspective, since evaluation goes towards a continuous follow-up of students' progress, yet grading is a final point in the learning process.

The study also observed that this difference is endorsed by the School of Education and a borderline is drawn with Engineering when teaching engineers have been trained as engineers but work as teachers. This invites them, *per se*, to also know these concepts that, although they come from Education, feed, dynamize, and make Engineering teaching and learning processes more effective. Teaching engineers admit that grading is easier than evaluating, which could be true since evaluation implies student monitoring, observation, and ways to approach their learning path. On the other hand, grading is only the numerical assessment of a test without necessarily mediating a follow-up that, in terms of learning, is quite necessary. It may be a little more wasteful, but that is part of the duties of a university professor because what must prevail is what the students learn, above any other consideration.

- Question 2. Can you explain the difference between evaluating and grading?

The question sought to confront teaching engineers because by admitting that they know the difference between evaluating and grading, researchers assumed that they could explain it but they could not. Quantitative results disprove this assumption. In statistical terms, admitting an affirmative or negative answer to a question is very easy and, at times, convenient; however, when one wants to address the subject, things change because researchers must demonstrate that an affirmative answer was indeed the correct one.

Some teaching engineers, as expected, argue that they understand the difference but cannot explain it. This is a debatable condition although notice that the objective of this study was not to confront these answers but to analyze them from a qualitative perspective.

Other teaching engineers consider that explaining the difference between grading and evaluating is for experts. Moreover, this is not true because although experts may have more elements of judgment to present their courses, it is still very useful

for teaching engineers to have the ability to explain it regardless of whether they are experts or not. After all, it is not the experts in Education who teach courses in engineering programs.

Likewise, the issue is imposed on the Schools of Education and is reinforced with the argument that explaining it is not easy. In general, it is perceived that one could have some idea of what it is to evaluate and what it is to grade, but one does not have enough knowledge to make it effective in the classroom regarding the course that is taught.

- Question 3. Do you evaluate or do you just grade?

The dialogues with the teaching engineers indicate that they consider, in introspect, that they always evaluate but that the way they do it is by grading. However, when we delve into how they do it, we can observe (from the researcher's perspective) that what they do is grade and not evaluate, that is, they go to a specific assessment and not to the assessment of a process. Some teaching engineers accept that it is possible that they "only grade", which reveals an awareness that allows us to think of evaluation as a way to value what students do and to reward their progress instead of a specific numerical grade.

There are still those who believe that it is the same, those who do not care about it, and those who consider that it is not important. Although these are opinions from the perspective of engineering teaching, we cannot forget that this is a two-sided construct: teaching on the one hand and engineering on the other. It is clear that all these elements make it possible to make teaching more effective regardless of the academic disciplinary context in which it occurs. Therefore, this type of response raises the need to create awareness regarding teaching engineers' roles to train future engineers from the perspective of a training process framed in the context of a higher-level educational institution.

- Question 4. Are your midterm knowledge tests intended to evaluate or grade?

This is another of the questions that seek to confront the previous answers. In addition to the research objectives of this study, it aims to take advantage of this space to generate awareness regarding the subject matter needed to understand, conceive, appropriate, and evaluate as a motivating assessment mechanism of students' progress instead of grading. Hence, teaching engineers respond that they aim to evaluate, which is the underlying purpose of their teaching work, although this is not confirmed by the previous answers.

Some teachers accept, openly, that what they are doing is grading, with which they also accept that the difference between grading and evaluating is not within their

concerns and that they consider specific assessment sufficient to fulfill their teaching work. Others go further, they do not even know if they are grading fairly. That is, they do not know if the criteria and rubrics they adopt to grade do justice to students' efforts, advances, and studies, but this is the subject of another article.

In a standard idea, some teaching engineers accept that they grade to know who passes and who does not. It can be understood that a grade does not have a connotation based on learning but instead on being promoted to the next course. Although grading is not the only strategy that is desirable to value what students learn, it cannot be ruled out that with creativity, teachers can turn it into an instrument to motivate learning, reinforce it, and create ways in which students improve their learning. Other teachers consider that grading is the form of evaluation they adopt, which confirms a lack of knowledge of the difference between grading and evaluating, which, in itself, invites the establishment of training programs so that, based on this difference, learning can be motivated and promoted in any field of engineering.

1. QUESTION 5. CAN YOU SHOW US A WRITTEN EVALUATION?

This is the most challenging question for teaching engineers because it is the one that crystallizes everything they would have said or commented on in the previous questions. It should be noted that the questions were answered in a cordial atmosphere, with a dialogue and fluent conversation, opening space for comments and observations on the subject. Regarding this, teaching engineers are urged to show a written evaluation to verify the profile of the design with which they built it and, from there, to know the details of the evaluation of what students do. Several did so, approximately two-thirds, but a third of them did not do so because of respectable reasons. When observing the written tests of those who took them, researchers observed that, indeed, a trend more towards grading than evaluation is confirmed, not only because of what teaching engineers say but also because they explicitly state so. Those who did not want to show their evaluations argued for privacy, to which they are entitled, and others argued for academic freedom, which is also absolutely respectable. This was not a matter of confronting them but of voluntarily inviting them to make such a presentation of their written evidence.

CONCLUSIONS

Taking into account that the objective of the article was to present and analyze the results obtained in an inquiry in which teaching engineers from the Eje Cafetero region were approached about their experience between what it is to evaluate and grade in different engineering program courses and from the results obtained and the analyses carried out, It can be concluded a) that teaching engineers seek to strengthen their profile more as

engineers than as teachers, either from training courses or high-level training and that this makes them academic references of their engineering knowledge but far from their work. b) Advanced training is needed for teaching engineers so that they understand, among many things concerning teaching (half of their profile as teaching engineers), the difference between evaluating and grading and everything that derives from it. It should not be forgotten that this is the final phase of a teaching and learning process and that, therefore, it can be assumed that methodologies may be adopted to evaluate or methodologies to grade. They are exclusive paths, one is formative and the other is informative. c) It is worthwhile to create a program to raise awareness of the so-called hard sciences (engineering) against the so-called soft sciences (humanities) so that their contribution can be valued and understood as complementary in a world where disciplinary knowledge is needed but human beings with social sensitivity are also required to help build a better society. d) Furthermore, it is necessary to train teaching engineers in the different and multiple forms of evaluation to understand possibly unknown dimensions, judging by the results obtained, which dynamize learning and allow evaluation to become the most powerful tool to achieve it, as opposed to grading which, at times, turns out to be more demotivating than useful in these processes.

REFERENCIAS BIBLIOGRÁFICAS

[1] K. e. a. Pelletier, 2022 Educause Horizon Report - Teaching and Learning Edition, Boulder, CO: Educause, 2022.

[2] B. Shirazian, Theory of knowledge assessments, New Jersey: Kindle Editions, 2022.

[3] B. Diaz, Estrategias docentes para un aprendizaje significativo, Buenos Aires: McGraw Hill Interamericana, 2010.

[4] F. e. a. Chen, «Formation of ICT competence of future university teachers,» *Open Access Journal,* vol. 13, nº 8, pp. 4765 - 4777, 2017.

[5] L. Muñoz, Modelo de comunicación en Ingeniería basado en competencias blandas, Pereira: RudeColombia, 2020.

[6] K. R. S. Acevedo, «La educación en la sociedad del conocimiento,» *Revista Torreón Universitario,* vol. 8, nº 22, pp. 79 - 83, 2019.

[7] F. e. a. Buffa, «Concepciones acerca de la enseñanza en docentes de ingeniería,» *Educación en Ingeniería,* vol. 15, nº 30, pp. 18-25, 2020.

[8] J. Ben Haim, «Why the best engineers should study Humanities,» *The International Journal of Mechanical Engineering education,* vol. 28, pp. 195 - 200, 2000.

[9] D. Ausubel, The acquisition and retention of knowledge, N.Y.: Springer, 2012.

[10] N. e. a. Dabbagh, Meaning Online Learning, Londres: Routledge, 2018.

[11] R. Santana, Como desenvolver suas hard skills e soft skills, Sao Paulo: Kindle Edition, 2021.

[12] J. Alves, N. Lima y G. Alves, «Adjusting higher education competencies to companies professional needs,» *International Journal of Human Capital and Information Technology Professionals,* vol. 8, nº 1, pp. 66-77, 2017.

[13] J. Bruner, Actos de significado, Buenos Aires: Gedisa, 2010.

[14] J. Bruner, «Apuntes sobre sociología en educación superior en varios contextos» *Estudios pedagógicos,* vol. 25, nº 2, pp. 203-230, 2009.

[15] L. Aznarurian, Conectivismo: Una teoría de aprendizaje en la era digital, Madrid: Editorial Académica Española, 2017.

[16] G. Siemens, Knowing Knowledges, Morrisville (NC): Lulu.com, 2006.

[17] C. Cobo y J. Moravec, Aprendizaje invisible: hacia una nueva ecología de la educación, Barcelona: Publicacions i Edicions Universitat de Barcelona, 2011.

[18] R. Day, How to write and publish scientific works, Washington: The Oryx Press, 2005.

[19] J. e. a. Barbara, «How to write a scientific article,» *International Journal of Sports Physical Therapy,* vol. 7, nº 5, pp. 512 - 517, 2012.