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Artículos científicos

El perfil del docente de física como factor en el desarrollo de las competencias del estudiante en el bachillerato

The profile of the physics teacher as a factor in the development of student competencies in high school

O perfil do professor de física como fator de desenvolvimento das competências do aluno no ensino médio

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Resumen

La Escuela Preparatoria No. 7 del Sistema de Educación Media Superior (SEMS), perteneciente a la Universidad de Guadalajara (UdeG), cuenta con el modelo educativo Bachillerato General por Competencias, el cual plantea un proceso de enseñanza-aprendizaje con una orientación constructivista, que busca que el estudiante desarrolle competencias mediante la aplicación del conocimiento tomando en cuenta el contexto y la realidad social. Dentro del perfil académico del docente que imparte la unidad de aprendizaje de Física II, se menciona la necesidad de relacionar las competencias técnico-pedagógicas y la experiencia en un campo disciplinar análogo, con el propósito de realizar planeaciones didácticas, diseño, evaluación de estrategias y actividades de aprendizaje orientadas al desarrollo de competencias. Sin embargo, al terminar el bachillerato e ingresar al nivel superior, los estudiantes no obtienen notas favorables. El presente trabajo busca determinar las competencias, habilidades y conocimientos que deberá poseer un docente que enseña física para lograr que el estudiante desarrolle las competencias necesarias según el perfil de egreso en la educación media superior. Para ello, se presenta un análisis histórico de los resultados de la evaluación por competencias mediante los exámenes transversales, el perfil de los docentes (disciplinar y pedagógico), así como una evaluación docente realizada por los alumnos, una entrevista al director del plantel, a los docentes y a los estudiantes. Con ello se identifican las estrategias de actualización y capacitación para los docentes que imparten clases en la unidad de aprendizaje de Física II en la Escuela Preparatoria No. 7.

Palabras clave: física, formación docente, pedagogía, proceso de enseñanza-aprendizaje, profesor de física.

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Abstract

The educational model of Preparatory School No. 7, of the Higher Secondary Education System (SEMS, for its acronym in Spanish), belonging to the University of Guadalajara (UdeG), proposes a teaching-learning process with a constructivist orientation, which seeks that the student develop competencies through the application of knowledge taking into account the context and social reality. Within the academic profile of the teacher who teaches the Physics II learning unit, the need to relate the technical-pedagogical competences and the experience in a similar disciplinary field is mentioned, with the purpose of carrying out didactic planning, design, evaluation of strategies and activities of learning oriented to the development of competences. However, upon finishing high school and entering the higher level, students do not obtain favorable grades. This work seeks to determine the competencies, skills and knowledge that a teacher who teaches physics must possess in order for the student to develop the necessary competencies according to the profile of graduation. For this, a historical analysis of the results of the evaluation by competences is carried out and the profile of the teachers is discussed (disciplinary and pedagogical); The results of a teacher evaluation carried out by the students are also discussed, as well as the responses obtained from interviews with the campus principal, teachers and students. With this, the updating and training strategies for the teachers who teach in the Physics II learning unit at Preparatory School No. 7 are identified.

Keywords: physics, teacher training, pedagogy, teaching-learning process, physics teacher.

Resumo

A Escola Preparatória nº 7 do Sistema de Ensino Médio Superior (SEMS), pertencente à Universidade de Guadalajara (UdeG), possui o modelo educacional Bacharelado Geral por Competências, que propõe um processo de ensino-aprendizagem com orientação construtivista, que visa o aluno desenvolver competências através da aplicação de conhecimentos tendo em conta o contexto e a realidade social. No perfil acadêmico do professor que leciona a unidade curricular de Física II, é mencionada a necessidade de relacionar competências técnico-pedagógicas e experiência em área disciplinar semelhante, com o objetivo de realizar planejamento didático, desenho, avaliação de estratégias atividades de aprendizagem destinadas ao desenvolvimento de competências. Porém, ao

concluir o ensino médio e ingressar no nível superior, os alunos não obtêm notas favoráveis. Este trabalho visa determinar as competências, habilidades e conhecimentos que um professor que ensina física deve possuir para que o aluno desenvolva as competências necessárias de acordo com o perfil de graduação do ensino médio. Para tal, é apresentada uma análise histórica dos resultados da avaliação por competências através de exames transversais, do perfil dos docentes (disciplinar e pedagógico), bem como uma avaliação docente realizada pelos alunos, uma entrevista com o director do campus, professores e alunos. Com isso, são identificadas as estratégias de atualização e formação dos professores que lecionam na unidade de aprendizagem de Física II da Escola Preparatória nº 7.

Palavras-chave: física, formação de professores, pedagogia, processo ensino-aprendizagem, professor de física.

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Introduction

The Physics learning unit is offered within the General Baccalaureate for Competences of the Higher Secondary Education System (SEMS) that the University of Guadalajara (UdeG) has, a parastatal body that provides higher education in the state of Jalisco, Mexico.

Due to the fact that the Physics subject has a higher failure rate, it is necessary to identify the method through which it is taught, in order to find strategies that cause greater interest from students. However, not only is it enough to identify the most appropriate strategy, but the commitment of the teacher to improve teaching is essential.

It is equally important to highlight that the teaching profile of the Physics II learning unit taught at the Preparatory School No. 7 of the SEMS of UdeG lacks a pedagogical specialization; They only have a professional profile, that is, a bachelor's, postgraduate or diploma in the field.

Taking into account the above, this research arises in order that the profile of the teacher of the subject in question has a series of tools and training so that it can generate the required competencies in the students of Preparatory School No. 7.

The question that triggered this research was the following: what competencies, skills and knowledge would it be advisable for a teacher who teaches physics to have so that the student develops the necessary competencies according to the profile of graduation in upper secondary education?

A qualitative methodology was used, through a case study, with a mixed approach, and a quasi-experimental sample. Qualitative information was collected through interviews with the director, teachers and students, in addition to the development and application of an instrument for teacher evaluation; in turn, the average obtained by the students in their cross-sectional results was determined and analyzed. This is complemented by the application of the descriptive method, which is used to evaluate the teaching profile of the teachers who teach the Physics II learning unit. The research technique used was the interview by means of general questions to the teachers.

General aspects of teaching in the Physics learning unit in the General Baccalaureate by Competences

Physics is a basic pillar that every person must acquire as part of the necessary skills for development in daily life (Harari, 2016). Furthermore, as is well known, it is closely related to mathematics. The Physics learning unit is offered within the General Baccalaureate by Competences in the 174 campuses of the SEMS of the UdeG.

This subject has the highest rate of unsuccessful students in the entire curriculum, continuing with the learning units of Mathematics and Chemistry, all of which belong to the area of science. This, in many cases, is because students do not give the importance due to the subject. They automatically conceive it as a difficult unit to approve that, at the same time, lacks practical sense, in addition to being time-consuming and emphasizing logical-mathematical and scientific thinking.

The Data Analysis System [SAD] (2018) of UdeG, specifically for High School No. 7, indicates that in the 2018B calendar, 916 students failed in general; 347 of this did not pass Physics I and Physics II, which corresponds to 37.88%. Subsequently, in the 2019A calendar, an increase was generated: 65 more students failed. In both cases, the average that students in this condition have is low. And even those students who manage to pass the Physics

learning unit, for the most part, do not have the necessary skills to enter the university level, according to the data of the 2019A and 2019 B admission process of the UdeG.

The general information that was obtained from the Physics II cross-sectional exams of High School No. 7, in the 2019B calendar, is shown in table 1.

Tabla 1. Promedio de resultados obtenidos por los estudiantes de Física II en el examen transversal del ciclo 2019B

Academia de Física			**Prepa 7**		
Unidad de aprendizaje	**Total de exámenes**	**Promedio**	**Total de exámenes**	**Promedio**	**Cumplimiento (%)**
Física II	11 533	37.98	687	36.4	82.5

Fuente: Elaboración propia

In the curriculum of the General Baccalaureate by Competences, which is divided into six semesters, it is established that first semester students must take the Physics I learning unit; for the second semester, they are expected to study Physics II (Higher Secondary Education System [SEMS], 2015). This time difference allows for a school delay in the first semesters. When the student passes to the third semester owing a learning unit corresponding to the first, she will only have another opportunity to pass, so it is difficult, although not impossible, for the student to fail the same subject more than three times. As stated in the General Regulations for the Evaluation and Promotion of Students of the University of Guadalajara (H. Consejo General Universitario, 2006), the student has the right to recover this subject in order not to be retained during half of their studies.

In order to find strategies that arouse greater interest on the part of students in the subject of Physics, it is necessary to identify, first of all, the teaching method currently applied. And coupled with this, the commitment of the teacher to improve teaching is essential, "since it is not about convincing, or forcing the student to learn, but rather to motivate in her an interest in discovering, innovating and using her creativity" (Kilpatrick. , Rico and Sierra, 1994, p. 137). Thus, a key factor in student motivation lies mainly with the teacher (Cermeño, 2016). The enthusiasm, dedication and orientation of the tasks that are developed in the classroom is an effective measure.

Undoubtedly, it is necessary for students to have greater preparation to face changes in professional, work and personal life. For this to be achieved, it is essential to make alterations in the teaching-learning processes: generate in students greater skills for the acquisition of knowledge and problem solving and thus make them competitive when integrating into society (Torres, Badillo, Valentin and Ramírez, 2014).

The student does not question whether or not the teacher has the necessary skills to achieve school development, since, for him, the teacher only teaches the subject; However, what is intended with this study is to identify what knowledge, skills and strategies are available to encourage students to develop the skills required at the time of graduation. These characteristics are defined by affinities and according to the characteristics of each one. The objective is to generate a strategy that homogenizes the profile of teachers and favors the graduation profile of students in Preparatory School No. 7.

For this, it is important to take up information about teacher training. According to Shulman (2005), the professional knowledge of teachers is distinguished by seven elements:

1) Knowledge of the content.
2) General didactic knowledge.
3) Knowledge of the curriculum.
4) Didactic knowledge of the content.
5) Knowledge of the students and their characteristics.
6) Knowledge of educational contexts.
7) Knowledge of the educational objective, purposes and values and of their philosophical and historical foundations

A teacher should not simply have knowledge of the profession; Beyond being a specialist in these contents, it is essential that they acquire knowledge about pedagogy, which will have repercussions when taking into account the competences, skills and strategies that are required for students to develop an interest in learning and, by extension, the competences necessary.

Leal (2014) talks about the importance of combining the content of the subject with the teaching of it. He calls this didactic knowledge of content, and characterizes it from four elements:

1) It is contextualized, both at the content level of the subject and at the instructional level.
2) It consists of transforming, transferring and transposing the didactics of the content for teaching.
3) It requires special characteristics for its training and study with teachers.
4) For teacher training, it requires reflection and application on the action, the integration of psychology and content, the investigation of the discipline and studies of different ways of representing the content to be taught (Pinto, 2010, p.13).

In addition, it is important to mention that the teacher's profile is related to a series of personal behaviors that are rescued from the diversity of capacities, values, attitudes, behaviors and cognitive styles of the teacher, which is instructed to the student. Hence, the characteristics of the teacher allow to generate in the student the interest in learning, the restlessness of the learning process and the application of said knowledge to her life. Araque (2017) refers to the fact that the teacher no longer only has to teach content, but must transmit learning experiences in order to motivate the student's capacity for wonder. It is worth noting that teachers currently face more demands and challenges from students, which, again, directs them not to simply transmit knowledge, but it also becomes necessary to teach students to learn , to be aware of their own learning.

The above leads to a change in the role of the teacher and the relationship between teacher-student and student-teacher. Here, the teacher no longer exclusively enters the classroom to teach his class, without having any interaction with the student, because, although the teacher is not aware, he transmits values and attitudes that generate empathy in the students so that they feel identified with him . Molina and Pérez (2006) mention that the knowledge that the teacher wants to transmit is a part of the message that the student manages to capture in the classroom.

In the study by Covarrubias and Piñas (2004) he emphasizes the relationship that exists between the teacher and his students, which has a lot of prominence during the teaching-learning process: it is a factor that intervenes in learning, behavior, commitment and even the attitude to study.

When it is intended that the student learn in science, it is necessary to carry out processes to implement the development of competencies, so it becomes essential to solve problems, carry out projects, solve cases, work with experiments, research, among others, in order to find that The student inquires and questions the way in which they will solve each of these tasks to acquire learning, which leads them to generate their own teaching through a natural process (Frade, 2015).

And why is competency development taught? Competency-based education is created by the need to link training with work; school relates knowledge to life: it makes theory practical. Therefore, it is necessary for the student to be able (at the end of their training) to demonstrate the acquisition of competencies, without neglecting the demonstration of the theoretical and conceptual domain, which are a substantial part, where the processes are evaluated and not only the results. Cázarez and Cuevas (2007) call the way learning is built spiral of competences, so that the scaffolding is carried out based on the results and products that serve for new creations (basic learning).

In this sense, Chan and Delgado (2009, cited in Torres et al., 2014) refer that the responsibility of the teacher is "to manage learning environments, interpret the expressions and behaviors of the learner and communicate with him to support him in his process" (p. 137). Along the same lines, agreement 447 of the Ministry of Public Education [SEP] (2007) establishes the characteristics of teaching competences for upper secondary education, which contribute to teacher training and continuous improvement of the teaching process -learning, including fostering motivation in students during the process.

Materials and method

For the investigation of the competence factor of the teaching profiles of the Physics II learning unit of the UdeG baccalaureate, the profile of the teachers, the competencies developed by the students and the results obtained from the teacher evaluation are analyzed. These elements are analyzed as follows:

- Based on professional knowledge, the teacher profile is analyzed based on what Shulman (2005) mentions.
- The competencies acquired by the students are worked through the transversal exams that are applied at the upper secondary education level of the UdeG, since they are

based on the Physics II competency program, and show the competences that the student must acquire upon passing the unit in question (SEMS, 2015)

- For the teacher evaluation, the teacher's competencies established in Agreement 447 were taken into account (SEP, 2007)

According to Hernández, Fernández, and Baptista (2014), the approach used for our case study is mixed, with a quasi-experimental sample. The qualitative information was collected through interviews with the principal, teachers and students, in addition to the development, as well as application, of the instrument for teacher evaluation, thanks to which quantitative results were obtained, also interpreted qualitatively. Finally, the average obtained by the students in their cross-sectional evaluations was reviewed and evaluated (see annexes).

The sample was made up of teachers who teach the Physics II learning unit and second semester students who take this subject from Preparatory School No. 7, which is located in the Guadalajara Metropolitan Area (ZMG) , in Jalisco, Mexico. It should be noted that, due to the high demand that this campus has, a high score is required from students in the admission exam.

The school is made up from the academic part by a staff of 196 teachers, who are distributed in five departments with their respective academies. Physics, along with other academies, is part of the Department of Understanding of Science. This academy consists of 11 teachers; of them, only six are those who teach Physics II.

Until 2019B, the school registered a total of 4,989 students (distributed in six semesters of 10 groups each and two shifts). Students who take Physics are between the first and second semester. In Physics II there are 900 students. For this case study, we worked with a quasi-experimental sample because the study was carried out with three teachers who teach the Physics II learning unit and their respective students.

The ideal teaching profile for the teaching of said learning unit demands a series of technical-pedagogical competences that cover several processes: didactic planning, design and evaluation of strategies, learning activities, information management and use of information technologies and communication (ICT) (SEMS, 2015).

Regarding the experience in a disciplinary field, it establishes a professional or disciplinary training in sciences related to the learning unit, preferably in physics, geography, engineering, or having taken courses, diplomas or others (presenting the supporting

documents of socially recognized institutions, which will be evaluated and reviewed by the corresponding departmental school), which endorse the knowledge, understanding and pedagogical management of the contents of this curricular learning unit.

However, most of the teachers who apply to teach classes in the Physics II learning unit have merely the professional profile, and not the pedagogical one. Although the aspiring teachers have a bachelor's degree, they do not have specialized training in the pedagogical area, as can be seen in table 2.

Therefore, during the period 2012-2017, the Teacher Training Program (Profordems) was established in the SEMS, which aims to train teachers of upper secondary education schools to contribute to the achievement of the teacher profile, which is established in the Comprehensive Reform of Higher Secondary Education (Riems), which, in turn, aims to offer a specialty in teaching skills at the National Pedagogical University (UPN) to the institutions affiliated to the National Association of Universities and Institutions Higher Education (Anuies). In addition, its purpose is to pay the teacher profile a series of competencies defined in Secretary Agreement 447 (SEP, 2007), which can be developed by teachers during the diploma. At the end of the course, the teacher has the possibility of accessing a method to become certified in this specialty, either through the Middle Upper Level Teacher Certification Program (Certidems), which implies work with an original and innovative contribution to improve the training of high school graduates, as well as an interview to identify aspects in the development of teaching competencies, or the Process of Evaluation of Teaching Competences for Higher Secondary Education (Ecodems), which has two phases, a knowledge and skills examination cognitive and performance evaluation that collects and verifies evidence of performance, product and attitude.

The teachers who teach Physics II at Preparatory School No. 7 have the following training (table 2):

Tabla 2. Profesores de la Preparatoria No. 7, con sus perfiles y especialidades

		Cantidad de profesores				
Profesores	**Licenciatura**	**Licenciatura**	**Maestría**	**Profordems**	**Ecodems**	**Cetidems**
Profesor A	Ingeniero en Electrónica y Comunicaciones	1	1	1	0	1
Profesor B	Ingeniero Mecánico Eléctrico	1	0	1	1	0
Profesor C	Ingeniero Civil	1	0	1	1	0
Profesor D	Ingeniero Químico	2	0	0	0	0
Profesor C	Ingeniero Industrial	1	0	0	0	0

Nota: El profesor A cuenta con maestría en Tecnologías para el Aprendizaje

Fuente: Elaboración propia

With the interview with the campus principal (Annex 1), the above information was obtained. Then, following the typology of Campbell and Stanley (1966), tables 3 and 4 were designed.

Tabla 3. Simbología básica para diseños experimentales

R	Asignación al azar o aleatoria. Cuando aparece quiere decir que los sujetos han sido asignados a un grupo de manera aleatoria.
G	Grupo de sujetos o casos (G1, grupo 1; G2, grupo 2; etcétera).
X	Tratamiento, estímulo o condición experimental (presencia de algún nivel o modalidad de la variable independiente).
0	Una medición de los sujetos de un grupo (prueba, cuestionario, observación, etc.).
—	Ausencia de estímulo (nivel "cero" en la variable independiente). Indica que se trata de un grupo de control o testigo.

Fuente: Elaboración propia

From the above, the teaching characterization is designed:

1) G1 X1: professor with a related degree or engineer, has a postgraduate degree, specializing in teaching skills and certification.

2) G2 X2: professor with a related degree or engineer, has a specialty in teaching skills and certification.

3) G3 X3: professor who has a related degree or engineer, and who does not have a specialty in teaching skills.

Following this typology, the information would be as follows (see table 4).

Tabla 4. Tipología para trabajar la categorización de los docentes de la Preparatoria No. 7

Profesores	**Condición experimental**	**Cantidad de profesores en grupo**
G_1	X_1	1
G_2	X_2	2
G_3	X_3	3

Fuente: Elaboración propia

The teacher interview was designed with general questions, opinion, to exemplify, background and sensitive, and were categorized based on knowledge of content, curriculum, objectives, general didactics, knowledge of the students and their characteristics, of their educational context and didactic content (annex 2).

The interview with the students was formulated with general, opinion, knowledge, background and sensitive questions. A total of 25 students per group from each teacher were interviewed (Annex 3).

The proposal of the teacher evaluation instrument (annex 4) was used during the 2019A calendar, because there was no instrument on the campus; It is based on the information on teaching competencies from Agreement 447 (SEP, 2007). This instrument was applied at the end of the semester to a sample of students by groups. The objective was to evaluate each teacher who taught the learning unit during that calendar. In this survey, questions were asked about the teaching activity, its didactic characteristics and teaching techniques. It consisted of 25 questions on a Likert scale. In short, it serves to identify the points of improvement in the teaching-learning processes for the learning unit in question. Table 5 presents the results and the interpretation of the teacher evaluation in each competence.

Tabla 5. Tabla de interpretación de la evaluación docente en cada competencia

Competencias docentes		**Escala de interpretación**				
		No deseable	**Regular**	**Bueno**	**Muy bueno**	**Excelente**
1	Formación continua	0-5	6-10	11-15	16-20	21-25
2	Dominio de saberes	0-3	4-6	7-9	10-12	13-15
3	Planificación de procesos	0-7	8-14	15-21	22-28	29-35
4	Aplicación de estrategias por competencias	0-8	9-16	17-24	25-32	33-40
5	Evaluación de procesos	0-6	7-12	13-18	19-24	25-30
6	Ambientes de aprendizaje autónomo	0-10	11-20	21-30	31-40	41-50
7	Ambientes de formación integral	0-7	8-14	15-21	22-28	29-35
8	Participación en proyectos	1	2	3	4	5
Valoración final		**0-47**	**48-94**	**95-141**	**142-188**	**189-235**

Fuente: Elaboración propia

The student competency assessment exam, also under the name of transversal (Annex 5), was applied to all students, from second to sixth semester, in all learning units; The level of competence developed by student in each unit is mainly evaluated. In the case of Physics II, the evaluation consisted of 20 questions on topics related to the contents taught there, taking into account the generic competences listed below:

- CG5. Develops innovations and proposes solutions to problems based on established methods.
- CG5.1. Follow instructions and procedures reflectively, understanding how each of your steps contributes to achieving a goal.
- CG5.2. Sort information according to categories, hierarchies and relationships.
- CG5.3. Identify the core systems and rules or principles that underlie a series of phenomena.
- CG5.5. Synthesize evidence obtained through experimentation to produce conclusions and formulate new questions.

This exam was validated by the Directorate of Continuing, Open and Distance Education of the UdeG, which is made up of teachers from the entire SEMS network who teach the Physics learning unit, who approved the questions reflecting the level of achievement of competence developed by the student, interpreting the level of achievement as shown in table 6.

Tabla 6. Tabla de interpretación de competencias del estudiante

Competencias estudiantes		**Escala de interpretación**				
		Insuficiente	**Básico**	**Suficiente**	**Avanzado**	**Óptimo**
1	CG5.1	1	2	3	4	5
2	CG5.2	0	-	-	-	1
3	CG5.3	0-1	2-3	4-5	6-7	8-9
5	CG5.5	0-1	2-3	4-5	6-7	8-9
Valoración final		**0-3**	**4-8**	**9-13**	**14-18**	**19-24**

Fuente: Elaboración propia

This allowed generating the codebook shown in table 7.

Tabla 7. Libro de códigos para la evaluación de competencias del estudiante de Física II

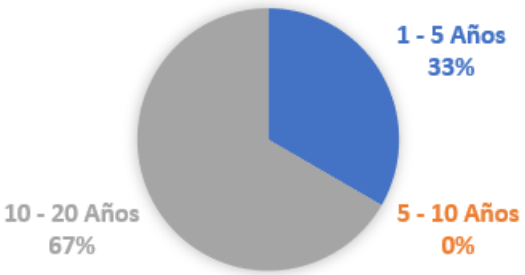
Variable	Categoría	Código	Preguntas
Estudiante	S1	25 (estudiantes)	-
Profesor	X1	1 (Profesor)	-
Evaluación de competencias de estudiantes	CG5.1	Correcto 1 Incorrecto 0	4, 5, 9, 12 y 16
	CG5.2	Correcto 1 Incorrecto 0	1 y 6
	CG5.3	Correcto 1 Incorrecto 0	2, 3, 6, 7, 8, 14, 15, 17 y 20
	CG5.5	Correcto 1 Incorrecto 0	3, 5, 7, 10, 11, 13, 16, 18 y 19

Fuente: Elaboración propia

Results

The results are obtained based on the teacher interviews and the following information is recovered.

Figura 1. Gráfico de la experiencia en docencia de Física II



Fuente: Elaboración propia

Figure 1 shows that the age differences in seniority in high school teachers are very marked. Teachers G1X1 and G2X2 have been teaching the Physics II unit for more than 10 years.

Within the questions on knowledge and curriculum, the following information was obtained:

- No teacher teaches classes in Higher Education.
- Teachers agree that they receive training offers every two times a year, but try to sign up for one.
- Teachers consider that due to their engineering profile and seniority they are suitable to teach Physics II.
- Within the general didactic content questions, the following information was obtained:
- The teachers agree that the semester is very short for the contents of the learning unit and that, from the totality of topics, they select those that they will be able to cover.
- They use the evaluation criteria set by the academy.
- They carry out practices, between five and seven per semester, however, they do not have the corresponding inputs (number of students) nor are they modern enough for the students.
- Regarding the failure rate, the teacher with the least seniority mentioned that their failure rate is medium (34% -67%), while the teachers with more seniority report that they maintain a low failure rate (0% -33%); Furthermore, this is a factor that is involved depending on the school calendar.

When inquiring about how they tell if students learn, the following answers were obtained:

- G1X1: By understanding natural phenomena, solving exercises and passing the exam.
- G2X2: Measures it through cross-sectional examinations
- G3X3: Considers it when students understand the basics from their feedback.

Regarding the actions they carry out to achieve the learning of their students, the following responses were obtained:

- G1X1: Exemplify each activity, with feedback, understand the needs of the students.
- G2X2: Prepare questions and answers, as well as prepare exercises on the spot and check the results
- G3X3: Ensuring that the student is correct within the basic terms of a class. Offer the most accessible way to create knowledge. Always with the thought of improving these actions to enrich the experience.

About the reason why their students do not learn, the following answers were obtained:

- G1 X1: They do not pay attention or there is a lack of interest regarding the subject.
- G2 X2: Due to the students' background, customs and especially previous studies.
- G3 X3: A lack of awareness on the part of the student and the teacher.

Now, from the evaluation carried out by the students regarding the performance of the teachers, the following information was obtained with respect to each teaching group within table 8 is group G_1, in table 9 is group G_2 and in table 10 is group G_3:

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Tabla 8. Evaluación de los docentes del grupo G_1 por sus estudiantes de Física II

Competencias docentes		**Escala de interpretación**					
		No deseable	**Regular**	**Bueno**	**Muy bueno**	**Excelente**	**Total**
1	Formación continua	0-5	6-10	11-15	16-20	21-25	Bueno
2	Dominio de saberes	0-3	4-6	7-9	10-12	13-15	Muy bueno
3	Planificación de procesos	0-7	8-14	15-21	22-28	29-35	Bueno
4	Aplicación de estrategias por competencias	0-8	9-16	17-24	25-32	33-40	Bueno
5	Evaluación de procesos	0-6	7-12	13-18	19-24	25-30	Bueno
6	Ambientes de aprendizaje autónomo	0-10	11-20	21-30	31-40	41-50	Bueno
7	Ambientes de formación integral	0-7	8-14	15-21	22-28	29-35	Bueno
8	Participación en proyectos	1	2	3	4	5	Bueno
Valoración final		0-47	48-94	95-141	142-188	189-235	Bueno

Fuente: Elaboración propia

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Tabla 9. Evaluación de los docentes del grupo G_2 por sus estudiantes de Física II

Competencias docentes		**Escala de interpretación**					
		No deseable	**Regular**	**Bueno**	**Muy bueno**	**Excelente**	**Total**
1	Formación continua	0-5	6-10	11-15	16-20	21-25	Regular
2	Dominio de saberes	0-3	4-6	7-9	10-12	13-15	Muy bueno
3	Planificación de procesos	0-7	8-14	15-21	22-28	29-35	Bueno
4	Aplicación de estrategias por competencias	0-8	9-16	17-24	25-32	33-40	Bueno
5	Evaluación de procesos	0-6	7-12	13-18	19-24	25-30	Bueno
6	Ambientes de aprendizaje autónomo	0-10	11-20	21-30	31-40	41-50	Regular
7	Ambientes de formación integral	0-7	8-14	15-21	22-28	29-35	Bueno
8	Participación en proyectos	1	2	3	4	5	Regular
Valoración final		0-47	48-94	95-141	142-188	189-235	Bueno

Fuente: Elaboración propia

Tabla 10. Evaluación de los docentes del grupo G_3 por sus estudiantes de Física II

Competencias docentes		**Escala de interpretación**					
		No deseable	**Regular**	**Bueno**	**Muy bueno**	**Excelente**	**Total**
1	Formación continua	0-5	6-10	11-15	16-20	21-25	Muy bueno
2	Dominio de saberes	0-3	4-6	7-9	10-12	13-15	Muy bueno
3	Planificación de procesos	0-7	8-14	15-21	22-28	29-35	Muy bueno
4	Aplicación de estrategias por competencias	0-8	9-16	17-24	25-32	33-40	Muy bueno
5	Evaluación de procesos	0-6	7-12	13-18	19-24	25-30	Muy bueno
6	Ambientes de aprendizaje autónomo	0-10	11-20	21-30	31-40	41-50	Muy bueno
7	Ambientes de formación integral	0-7	8-14	15-21	22-28	29-35	Muy bueno
8	Participación en proyectos	1	2	3	4	5	Muy bueno
Valoración final		0-47	48-94	95-141	142-188	189-235	Muy bueno

Fuente: Elaboración propia

In the teacher evaluation results, it can be identified that, regardless of the teacher profile and whether or not they have pedagogy courses, the students consider that the knowledge of the three teachers is very good.

In addition to observing that the teacher with less experience, and who only has a professional profile, generates very good comprehensive training and autonomous learning environments for students, relies on updated instruments and elements for said learning.

While, from the questions about opinion and sensitivity towards students, the following information was obtained in each typeface:

- 72% of the interviewed students expressed that the strategies used by the teacher make them acquire knowledge. The teacher makes sure they pay attention, explains several times until they understand and the information is clear, all of which means that he takes the time to clarify doubts and manages to empathize with them and guide them in the matter (G_2X_2 and G_3X_3)
- 28% describe that their teacher is not interested in whether they understand or not, he simply explains and continues with his class, in addition to putting the exercises strictly and continuing with the subject, without being patient when exposing or clarifying their doubts (G_1X_1) .
- 10% of students are interested in the subject and have also sought to participate in physics Olympics.
- 61% of students mention that their teacher links the learning unit with activities of daily living.
- 65% mention that in their school they give advice to students who have difficulty with the learning unit and only 8% have participated in the advice and it is due to the need to pass the subject.
- 37% of students indicate that their teacher sometimes uses technological tools for their learning (G_3X_3)

Based on the results of the evaluation in students of the transversal examinations, the average of the development of competencies of each teacher is obtained, according to their group, during the 2019A-2020A calendars (table 11).

Tabla 11. Promedio obtenido de la categorización docente de los estudiantes de Física II en los calendarios 2019A-2020A en escala de 100

Categorización docente	**Promedios 2019A**	**Promedios 2019B**	**Promedios 2020A**
G_1X_1	58.14	34.91	55.26
G_2X_2	58.59	37.09	53.63
G_3X_3	56.95	36.66	54.51
Promedio	57.89	36.23	54.47

Fuente: Elaboración propia

It is worth mentioning that according to calendar A or B, teachers face different challenges in the strategies to implement to obtain a better development of skills in students.

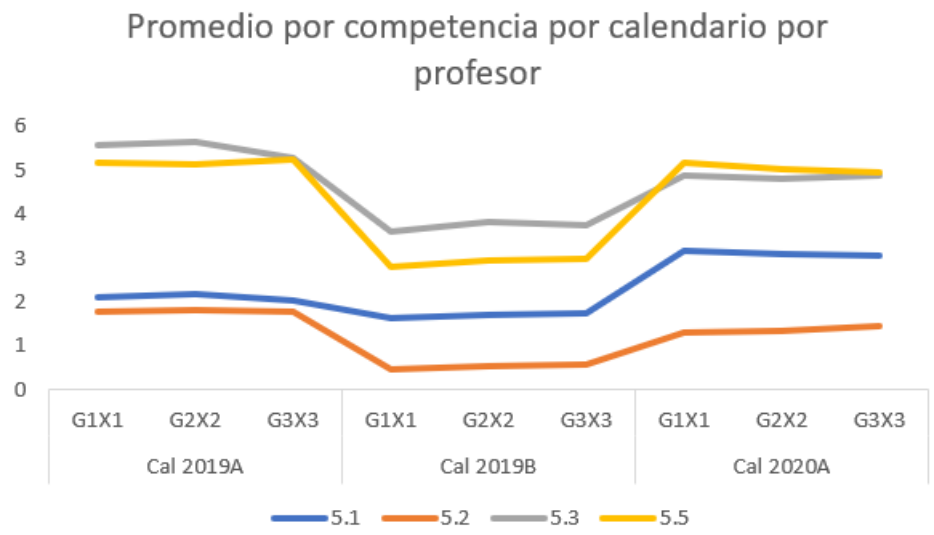
The data obtained with respect to the scale value of the development of skills in the student, according to the teacher and the calendar, are as follows (see table 12 and figure 2).

Tabla 12. Desarrollo de competencias del grupo por calendario

	Competencia de Estudiante			
2019ª	**5.1**	**5.2**	**5.3**	**5.5**
G_1X_1	2.11	1.78	5.56	5.17
G_2X_2	2.19	1.83	5.65	5.15
G_3X_3	2.04	1.78	5.29	5.25
	Competencia de Estudiante			
2019B	**5.1**	**5.2**	**5.3**	**5.5**
G_1X_1	1.62	0.47	3.61	2.82
G_2X_2	1.70	0.54	3.84	2.94
G_3X_3	1.75	0.57	3.74	2.99
	Competencia de Estudiante			
2020ª	**5.1**	**5.2**	**5.3**	**5.5**
G_1X_1	3.17	1.29	4.88	5.17
G_2X_2	3.09	1.35	4.81	5.02
G_3X_3	3.07	1.45	4.87	4.95

Fuente: Elaboración propia

Figura 2. Promedio de grupos de cada profesor en cada calendario



Fuente: Elaboración propia

Discussion

Based on the findings made during the investigation, it can be determined that Preparatory School No. 7 is made up of teachers who have a great difference in terms of experience teaching the Physics II learning unit. This work shows that there are teachers who exercise a traditional teaching to give classes; In addition, it was shown that a particular characteristic of teachers is their participation in the comprehensive reform for upper secondary education, so they understand the link between education and work, the change in the role of the teacher and relationships both within the classroom as outside of it, from which three fundamental associations are established: teacher-student, student-teacher and student-student; the teacher, consequently, becomes only a facilitator of knowledge. On the other hand, teachers who have less experience teaching Physics II and who do not have a certification of teaching competencies generate with students a certain inertia that, when planning processes and applying strategies at the level of competence, is evaluated as very good for the latter.

Regarding professional knowledge, based on the results of the teacher evaluation, it can be identified that the students evaluate the knowledge mastery of the three teachers as very good, regardless of their profile or whether or not they have knowledge of pedagogy.

In addition, the teacher with less experience, who simply has a professional profile, generates very good comprehensive training and autonomous learning environments and relies on updated instruments and elements for such learning.

These findings allow generating a relationship with the research question developed in this text; confirm the need for the teacher to have a specific profile for the achievement of teaching. It should be remembered that the question was: what competencies, skills and knowledge are appropriate for a teacher who teaches physics to have in order for the student to develop the necessary competencies according to the profile of graduation from upper secondary education?

Mainly, the findings of this work underscore the need for the teacher, in addition to their academic profile (which is the selection to teach classes), to have certain training on topics related to pedagogical and technological tools for the development of the competencies of the students. students, participation in seminars, experience forums in the classroom, the use of simulators and technological tools. If these trainings are carried out on a semester basis, it will be possible to acquire the skills so that students generate interest in learning, restlessness, motivation, capacity for wonder and get hooked on science, in addition to learning how to apply said knowledge in their daily lives (Arque, 2017). It is observed in the results that these strategies generate a positive effect on the students.

It should be noted that the limitation detected in this process resides in the fact that all the teachers of High School No. 7 who teach Physics II are engineers in some specialty, therefore, it is not possible to have a comparison with other profiles and point out, in case of There are, some other skills that achieve in the student the development of the competencies established in the graduation profile. For future research, it would be worthwhile to focus also on the conditions in which students enter the university, and to identify what is the assimilation of knowledge and mastery of the skills and abilities they achieve in the discipline of physics, as well as reviewing the trajectory of the teacher's profile, identify the tasks carried out in the classroom, the articulation, the contextualization of the content taught with the reality of the student and if it motivates learning; research that would be important to complement this work.

In this sense, it is suggested that the teacher who is hired to teach Physics II has a constant update in the development, generation and application of skills. And with this, form favorable learning environments that positively influence dropout rates, in addition to ensuring that students develop the necessary competencies for graduation from upper secondary education and for their entry into professional life.

Conclusions

Regarding the research question, it is proposed that the teacher who teaches the Physics II learning unit has a constant update in the application of both pedagogical skills and their profile. This is to generate favorable learning environments in order for students to develop the necessary skills once they have completed upper secondary education.

In addition, it is necessary that in the B calendars (August-December) teachers apply different strategies within the teaching-learning process; Furthermore, do not remain faithful with those that you use since the beginning of the teaching experience, because each generation is different, therefore, the strategies and the way it is taught must also be different.

The development of this research contributes to the fact that in Preparatory School No. 7 learning is based on the effective application of competencies that allow linking training with the work part. To achieve this, teachers have the duty to relate knowledge to everyday life, to make theory practical in some way.

Therefore, it is confirmed that the profile of the teacher is essential to ensure that the student is capable (at the end of her training) to demonstrate the level she acquired of skills and to manifest a theoretical and practical domain. The teacher should not simply have knowledge of the profession; It is necessary that they also acquire knowledge about pedagogy, which will have an impact on the students, taking into account the competencies, skills and strategies that each one requires.

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Anexo 1

https://www.cicata.ipn.mx/assets/files/cicata/Fisica/Documentos/Instrumentos/Preg_ent_dir_prepa_7.pdf

Anexo 2

https://www.cicata.ipn.mx/assets/files/cicata/Fisica/Documentos/Instrumentos/Preg_ent_docentes_Fisica%20II.pdf

Anexo 3

https://www.cicata.ipn.mx/assets/files/cicata/Fisica/Documentos/Instrumentos/Preg_ent_estudiantes_Fisica%20II.pdf

Anexo 4

https://www.cicata.ipn.mx/assets/files/cicata/Fisica/Documentos/Instrumentos/Inst_eval_estudiante_profesor.pdf

Anexo 5

https://www.cicata.ipn.mx/assets/files/cicata/Fisica/Documentos/Instrumentos/examen_trans_comp_Fisica%20II.pdf