

<https://doi.org/10.23913/ride.v12i23.1009>

Artículos científicos

Marco de trabajo de la función de tutoría universitaria para favorecer la permanencia estudiantil con enfoque cibernsistémico transdisciplinario

A framework of the university tutoring function to promote student permanence, with a transdisciplinary cyber systemic approach

Estrutura da função de tutoria universitária para promover a permanência do aluno com uma abordagem ciber-sistêmica transdisciplinar

Matilde Reséndiz-Castro

Instituto Politécnico Nacional, México

mresendizc1700@alumno.ipn.mx

<https://orcid.org/0000-0001-5419-7652>

Rosalba Zepeda-Bautista

Instituto Politécnico Nacional, México

rz0509@hotmail.com

<https://orcid.org/0000-0003-0988-8619>

Resumen

El abandono estudiantil es un fenómeno socioeducativo que afecta a todos los niveles educativos. En América Latina se necesita identificar factores asociados a la permanencia estudiantil a través de diagnósticos que identifiquen áreas de oportunidad específicas de cada contexto educativo. Por ello, el objetivo de la investigación fue crear un marco de trabajo de la función de tutoría universitaria, fundamentado en un enfoque comunicativo, con modelos representativos de las necesidades de interacción del contexto educativo que posibiliten un programa y plan de trabajo que incidan en la atención y permanencia de los estudiantes. El marco de trabajo se aplicó en un estudio de caso bajo un enfoque cibernsistémico transdisciplinario y de participación acción investigación. A nivel de intervención, se

tomaron como base en indicadores de un diagnóstico de estudiantes-profesores y empresas en tres categorías: académica (criterios de evaluación, calificaciones parciales, instrumentos de evaluación y tiempo de estudio), personal (vocación, plan de carrera) y económica (becas internas, bolsa de trabajo). La población estuvo integrada por estudiantes de un programa de estudios de una universidad tecnológica en México que cursaban (entre 2018 y 2019) los dos primeros periodos cuatrimestrales de su carrera. Los resultados muestran un ejemplo aplicativo de un marco de trabajo integrado por: 1) la fundamentación cibernética transdisciplinaria de la función de tutoría universitaria, y 2) dos modelos: modelo de tutoría universitaria integral y modelo de gestión sistémico de la tutoría universitaria. A partir de estos se obtuvo: i) un programa institucional general de tutoría, y ii) su planeación de acción sistémica de tutoría con la clasificación de los indicadores, alineados con el modelo educativo estudio de caso y su modelo nacional de tutoría. Con la aplicación se obtuvo 76 % de permanencia estudiantil. En el tercer y hasta el penúltimo cuatrimestre no se aplicó el programa, y se obtuvo como resultado una permanencia de 38 %. Se concluye, por tanto, que aun cuando la mayoría de las investigaciones indica que en promedio se pierde 50 % de estudiantes en el primer ciclo estudiantil, se obtuvo 26 % por arriba de lo esperado. Por tal motivo, se puede afirmar que es necesario un programa de atención estudiantil integral que se retroalimente y se ajuste a las necesidades de los estudiantes abarcando la cantidad de estados posibles de estos durante toda su trayectoria académica, pues se registra un riesgo de deserción de hasta 50 % antes de la estadía industrial.

Palabras clave: Enseñanza y formación, industria y educación, ingeniería de sistemas, pertinencia de la educación, psicología de la educación.

Abstract

Student abandonment is a socio-educational phenomenon that affects all educational levels. In Latin America, it is to identify factors associated with student permanence through diagnoses that identify specific areas of opportunity in each educational context. To promote student permanence at the top level, the objective of this research was to create a framework for the university tutoring function. To this end, a case study was used under a cyber-systemic transdisciplinary approach to research participation. The population was a student of a curriculum at a Technological University in Mexico. The period of the investigation went from the last quarter of 2018 to the first quarter of 2019. Diagnostic indicators for students,

teachers and employers organized in three vulnerable areas were used: academic (evaluation criteria, partial qualifications, evaluation tools and study time), staff (vocation, career plan) and economic (internal scholarships, work bag). The results show an example of a framework composed of: (a) The transdisciplinary systemic cyber foundation of the university tutoring function; b) Two models: Integral University Tutoring Model and Systemic Management Model of University Tutoring. From the models was obtained c) General Institutional Tutoring Program and its d) Planning of Systemic Tutoring Action with the classification of indicators, aligned with the educational model case study and its national model of tutoring. Based on the information of the participating students during the first two semesters, a 76% student stay was quantified, with the application of the planning up to the second quarter. In the third and even the penultimate quarter, the program was not implemented, resulting in a 38% permanence. It is concluded that a student care program is needed that, in addition to its comprehensive implementation, is backed up and adjusted to the needs of students covering the number of possible student states.

Keywords: Teaching and training, industry and education, systems engineering, the relevance of education, psychosociology of education.

Resumo

A evasão escolar é um fenômeno socioeducativo que afeta todos os níveis educacionais. Na América Latina, é necessário identificar os fatores associados à retenção de alunos por meio de diagnósticos que identifiquem áreas de oportunidade específicas para cada contexto educacional. Portanto, o objetivo da pesquisa foi criar um referencial para a função de tutoria universitária, a partir de uma abordagem comunicativa, com modelos representativos das necessidades de interação do contexto educacional que possibilitem um programa e plano de trabalho que afetem a atenção e a permanência do alunos. O framework foi aplicado em um estudo de caso sob uma abordagem cibernética transdisciplinar e participação em pesquisa-ação. Ao nível da intervenção, tomaram-se como base indicadores de diagnóstico de alunos-professores e empresas em três categorias: acadêmica (critérios de avaliação, notas parciais, instrumentos de avaliação e tempo de estudo), pessoal (vocação, plano de carreira) e econômica (internas bolsas de estudo, banco de empregos). A população foi formada por alunos de um programa de estudos de uma universidade tecnológica no México que cursavam (entre 2018 e 2019) os dois primeiros quadrimestres de carreira. Os resultados mostram um

exemplo de aplicação de uma estrutura composta por 1) a base cibernética transdisciplinar da função de tutoria universitária, e 2) dois modelos: o modelo de tutoria universitária abrangente e o modelo de gestão sistêmica da tutoria universitária. Destes, i) obteve-se um programa geral de tutoria institucional e ii) seu planejamento de ações de tutoria sistêmica com classificação de indicadores, alinhado ao modelo educacional de estudo de caso e seu modelo nacional de tutoria. Com o aplicativo, obteve-se 76% de permanência do aluno. No terceiro e até o penúltimo semestre o programa não foi aplicado, obtendo-se como resultado uma permanência de 38%. Conclui-se, portanto, que embora a maioria das pesquisas indique que em média 50% dos alunos se perdem no primeiro ciclo, obteve-se 26% acima do esperado. Por isso, pode-se afirmar que é necessário um programa de atenção integral ao aluno que forneça feedback e se ajuste às necessidades dos alunos, englobando o número de estados possíveis destes ao longo de sua carreira acadêmica, pois há risco de evasão. a 50% antes da parada industrial.

Palavras-chave: Educação e treinamento, indústria e educação, engenharia de sistemas, relevância da educação, psicossociologia da educação.

Fecha Recepción: Febrero 2021

Fecha Aceptación: Agosto 2021

Introduction

There is vast information on the educational activities carried out in higher education institutions (IES) to improve academic performance indicators (AR), such as terminal efficiency and educational permanence. Most of the studies in Latin America from 1990 to 2016 show the relationships between the variables that intervene in student dropout, but only 5% are at an intervention level, another 5% refer to evaluation and only 11% They have dedicated themselves to modifying the reality of this phenomenon (Munizaga, Cifuentes and Beltrán, 2017). Educational transformation involves a series of mechanisms of set, feedback and interaction as a system. According to Cano (2001), RA must be identified in components of the educational system; This concept places emphasis on the integral development of the person and implies resorting to the functioning of the teaching and learning processes in their different areas, which would allow the knowledge of the educational status to improve areas

of opportunity and offer the conditions for the integral development of the students and the optimization of resources.

In this way, the functioning of the academy of the educational system in its effectiveness must converge with the industry as an ecosystem (Ison, 2011), impacting the flow of talent and knowledge to innovate at the local, regional and national levels (Ronde and Hussler, 2005) in a university-industry collaboration relationship (Hong, Zhu, Hou and Wang, 2019).

Although the role and socioeconomic relevance of the university is clear, it is clear that the teaching of classes is not enough. Given the increase in student enrollment (Esteve, 2003), educational models must diversify forms and strategies for collaborative retention of students. However, the challenge goes further, since the phenomenon of student dropout is potentiated by the multi-causality of the factors that affect it. According to Torres, Acevedo and Gallo (2015), the components can be personal, family and even cultural. For their part, Carvajal, Trejos and Gordillo (2017) indicate that teaching practice in the classroom can also be a cause of dropout.

Faced with such complexity, this research proposes an alternative with a holistic approach and an open system (Emery, 2004) with transformational transdisciplinary interventions (Wiek, Ness, Schweizer-Ries, Brand and Farioli, 2012) based on the mentoring function as a fundamental strategy in the university (Reséndiz-Castro, 2019) to articulate the communication and the accompaniment of the students in the academic trajectory (Romo, 2011). This, substantially, is made up of the interaction between students, teachers and employers, since its basic functions are feedback (Reséndiz, 2021). The systematization of communicative integration as the main function offers the possibility of creating organizational learning and contributing to institutional objectives. Highlighting the relationships between students, teachers and employers in the educational system allows distinguishing the learning concepts that every system must extract from its context and use

it as part of the praxis in the context / world of the student's life (Ison and Blackmore, 2014).

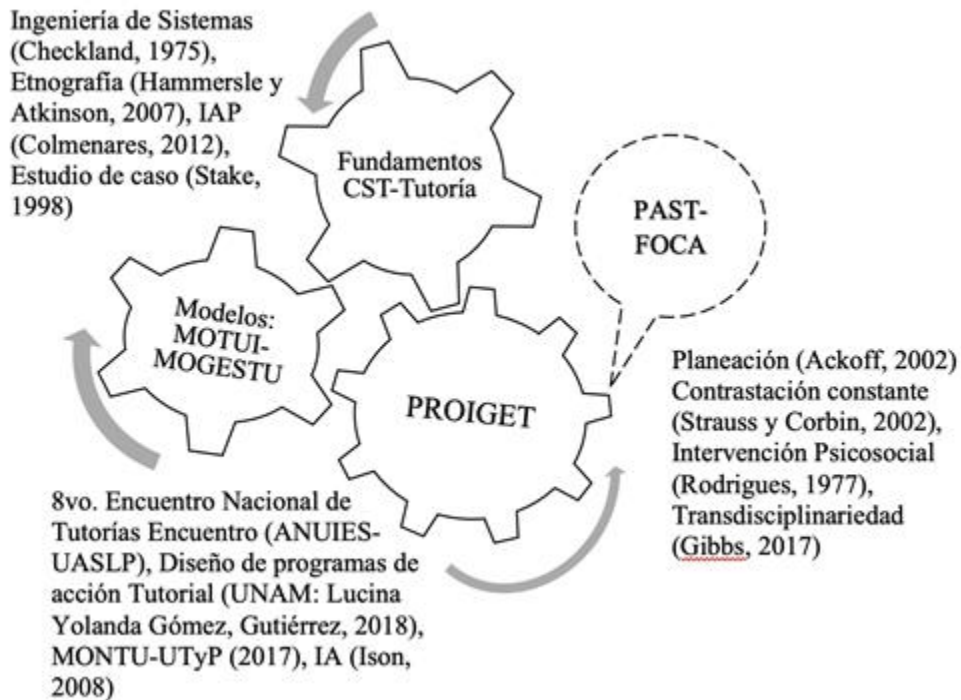
Therefore, the objective of this research is to show how the creation of a framework with a transdisciplinary cybersystemic approach of the university tutoring function (MATCITTU) favors academic permanence in an integral way.

Materials and methods

Demographic, socioeconomic, pedagogical, educational, equity and university-business collaboration indicators of three groups of students were used: two groups of new entry and one of the third semester. The tutoring function was used as an intervention strategy in a technological university (UT) at the higher technical university level (TSU) in the State of Mexico. The attention period comprised two semesters of 2018 and 2019. The intervention concentrated 64% of the total enrollment of students in an educational program as a case study (Stake, 1998), of which 21% were new entrants. Figure 1 shows the structure of MATCITTU, made up of: a) foundation of the university tutoring function with a transdisciplinary cyber-systemic approach (CST), b) Comprehensive University Tutoring Model (MOTUI) and University Tutoring Systemic Management Model (MOGESTU), aligned with the National Tutoring Model for the Technological and Polytechnic Universities of Mexico (MONTU-UTyP) (Institutional document prepared by the Rectors Commission of Topic 21: National Program of Tutorials and Student Support Services, for Technological Universities and Politécnicas de México, 2017), c) a General Institutional Tutoring Program (PROIGET) and d) Systemic Tutoring Action Planning (PAST) along with a planned calendar format of the activities to be developed (FOCA).

The intervention was of a psychosocial type (Rodrigues, 1977) in combination with systems engineering (Checkland, 2001), of an ethnographic nature (Hammersley and Atkinson, 2007), through participation action research (IAP) (Colmenares, 2012). A constant contrast was made (Strauss and Corbin, 2002) between the data collected and the reality to develop an interactive planning (Ackoff, 2002) with a transdisciplinary approach (Gibbs, 2017). Participant observation techniques, focused interviews, focus groups and organizational documents were used for data collection. (Hernández, Fernández y Baptista, 2007).

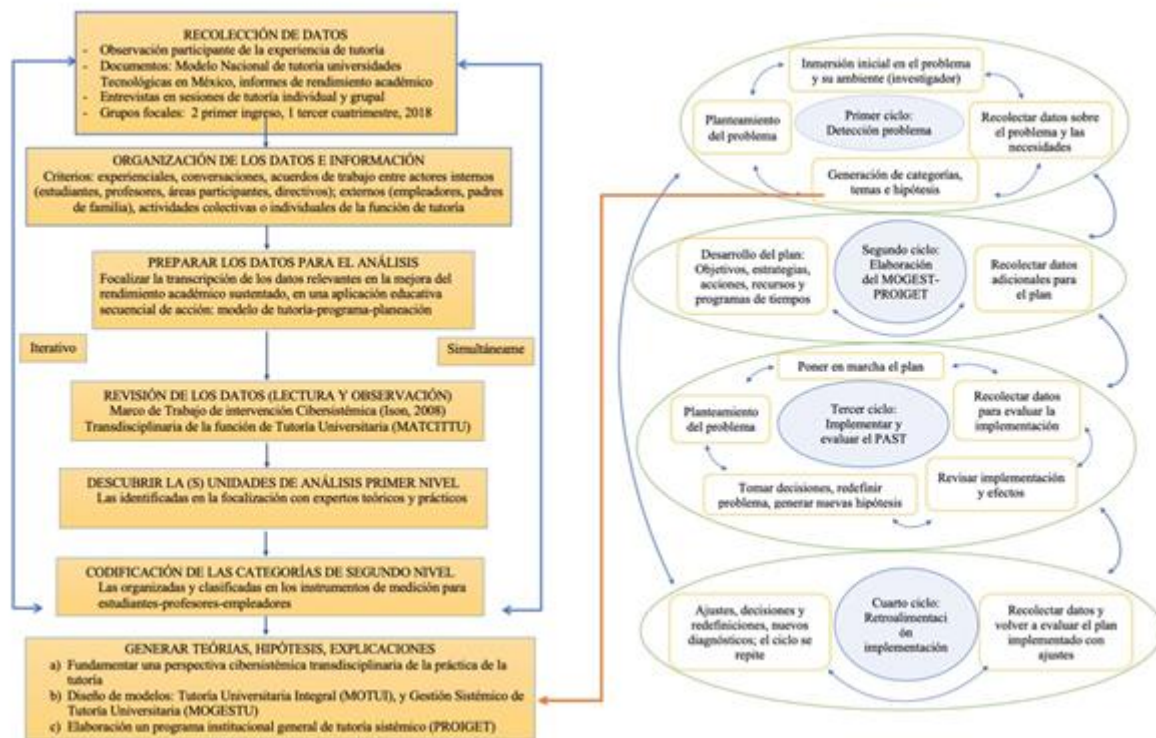
Figura 1. Componentes del marco de trabajo de intervención psicosocial con enfoque cibernético transdisciplinario de la función de tutoría universitaria



Fuente: Elaboración propia con base en Press (2015), Ison (2008) y Gibbs (2017)

Figure 2 shows the qualitative analysis process resulting from the planning, implementation, evaluation and feedback actions, which was elaborated from the triangulation of the data from the different sources used in their collection.

Figura 2. Proceso de organización de los datos del marco de trabajo con enfoque cibernsistémico transdisciplinario de la función de tutoría universitaria



Fuente: Elaboración propia con base en Hernández *et al.* (2007)

Results

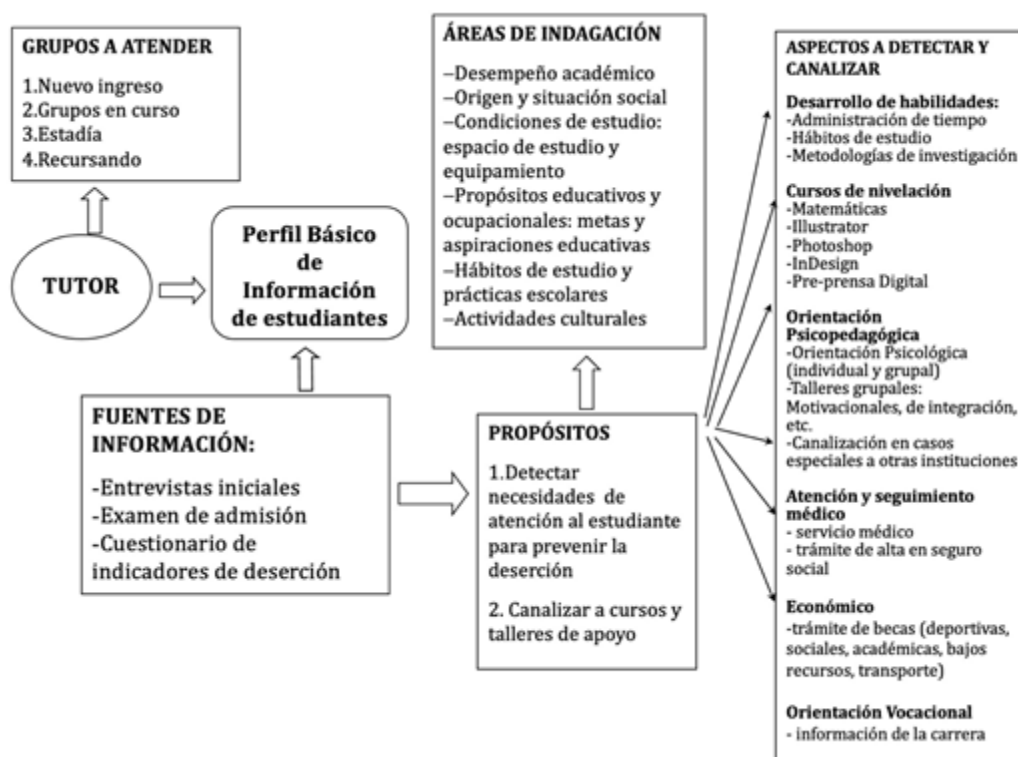
Foundation of the university tutoring function with the CST perspective

Background of the tutoring function in a technological university. The experience of teaching collaboration (Glasserman, Reséndiz and Riquelme, 2010) and of integrating students at work levels in congresses, publications and projects by a group of professors (Reséndiz et al., 2013) served as support to determine what it depends on. student performance. The researcher proposed a first tutorial work model to the educational program. The definition of tutoring that the National Association of Universities and Institutions of Higher Education (ANUIES) (2001) postulated as the main function in the accompaniment and teacher support based on personalized attention to favor a better understanding of the problems faced by the student in their process of adaptation to the university environment.

Individual aspects of each student were also considered to support her performance and achieve her academic goals. With this, she oriented the role of tutoring, the areas

involved, the levels of intervention and the resources that were used to support the permanence of the students. Figure 3 shows the tutoring model proposed by the researcher in 2011, which had been operating since 2008 and was used in the learning process for the certification of the study program in 2010. The model shows the target population of the tutor, the sources of information necessary for their attention, the areas of focus (school dropout premises) and the institutional resources to address the aspects detected as vulnerable.

Figura 3. Modelo de tutoría división académica de procesos de producción



Fuente: Elaboración propia

It was clear that the tutoring function could improve the performance of students, as it prepared them for their work tasks. However, even when the professional work as a tutor was able to support some students, the indicators of failure and student dropout continued, at the same time that a method was not achieved in which all the tutors were based to serve the students.

With the experience of exercising this function, the researcher began a search to scientifically propose a method of attention in the matter of backwardness and school dropouts to consolidate the long-term professional training of students. In 2017, with the

National Tutoring Model for the Technological and Polytechnic Universities of Mexico (MONTU-UTyP) (Institutional document prepared by the Rectors Commission of Topic 21: National Program of Tutorials and Student Support Services, for Technological Universities and Politécnicas de México, 2017), issued by the General Coordination of Technological and Polytechnic Universities (CGUTyP), an attempt was made to homogenize the tutoring function in the UT subsystem to favor permanence and terminal efficiency, measurable through control and monitoring indicators based on the standards of the Educational Model of Technological Universities.

The MONTU-UTyP explains that tutoring is a process of personalized accompaniment by teachers and specialists “during the training of students, which implements detection, orientation, channeling and monitoring strategies in the academic, socioeconomic and personal areas (...) in order to contribute to comprehensive training and the achievement of institutional objectives”(MONTU-UTyP, p. 10). In addition, it refers that they must self-evaluate the performance of the tutored students. The modality of attention can be individual, group or peer, as well as face-to-face or virtual. These antecedents served to make the theoretical foundation of the CST approach and the tutoring function.

Transdisciplinary cybersystem of mentoring. With a presentation by the author at the 8th National Tutoring Meeting organized by the National Association of Universities and Institutions of Higher Education (ANUIES) in coordination with the Autonomous University of San Luis Potosí (UASLP) in 2018, the capacity communication of tutoring to improve students' AR (Reséndiz-Castro, 2019). Gradually, the approach became a methodological approach to intervention in the doctoral program of Systems Engineering of the ESIME Zacatenco of the IPN (Reséndiz-Castro, Peón-Escalante and Zepeda- Bautista, 2018). The foundation was planted within the framework of MONTU-UTyP, which aims to develop an institutional tutoring program, to date non-existent in the university case study.

Comprehensive University Tutoring Model (MOTUI) and a Systemic Management Model for University Tutoring (MOGESTU)

Figure 4 shows a Comprehensive University Tutoring Model (MOTUI), where central aspects are appreciated to carry out an institutional tutoring action plan (PAT). The MOTUI incorporates the workplace represented by employers who request students for industrial stays for four months. It also integrates young applicants, and at the end of the

study program emphasis is placed on attending stays that involve the employer. Regarding the tutor-student interaction, the virtual aspect is a basic alternative of the educational offer. Once the MOTUI aspects had been configured, the MOGESICT was developed.

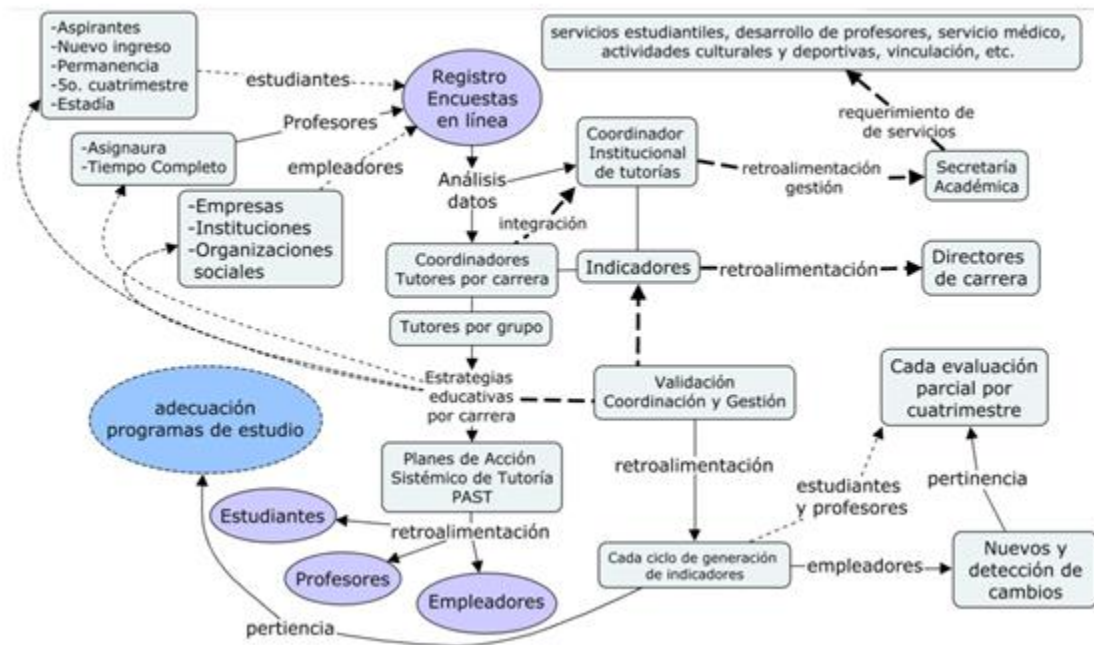
Figura 4. Modelo de Tutoría Universitaria Integral (MOTUI)



Fuente: Elaboración propia con base en Gómez (UNAM, titular del taller de diseño de un PAT en 8.º Encuentro Nacional de Tutorías ANUIES-UASLP, 2018)

Figure 5 shows the way in which communication should flow from tutor coordinators by academic division to group tutors to generate intervention strategies. The information flow allows to know in a way the diagnostic indicators and the feedback instances to validate a tutoring action plan by academic division.

Figura 5. Modelo de Gestión de la Tutoría Universitaria MOGESTU



Fuente: Elaboración propia con base en el modelo de Gómez (UNAM, titular del taller de diseño de un PAT en el 8.º Encuentro Nacional de Tutorías ANUIES-UASLP, 2018) y el Modelo Nacional de Tutoría (Universidades Tecnológicas y Politécnicas de México de 2017)

To evaluate the implementations of the tutoring function, it is proposed that the feedback have a holonic periodicity (Wilber, 2011) for each partial evaluation cut-off. This allows making the necessary adjustments during the stay of the students, at least three times in each semester and between each semester for at least one year to obtain results and feedback on the impact of the implemented strategies. The management is aligned with the MONTU-UTyP, which is why it incorporates career directors and the functions of the Academic Secretary for the management of specific student service requirements with each PAT and in general with an institutional student service program. Once the models are proposed, an example of an institutional program is suggested.

General Institutional Tutoring Program (PROIGET)

Table 1 shows the structural description of the aspects of PROIGET with functions, actions and interactions of the different levels of institutional organization.

Tabla 1. Descripción de aspectos de un Programa Institucional General de Tutoría (PROIGET)

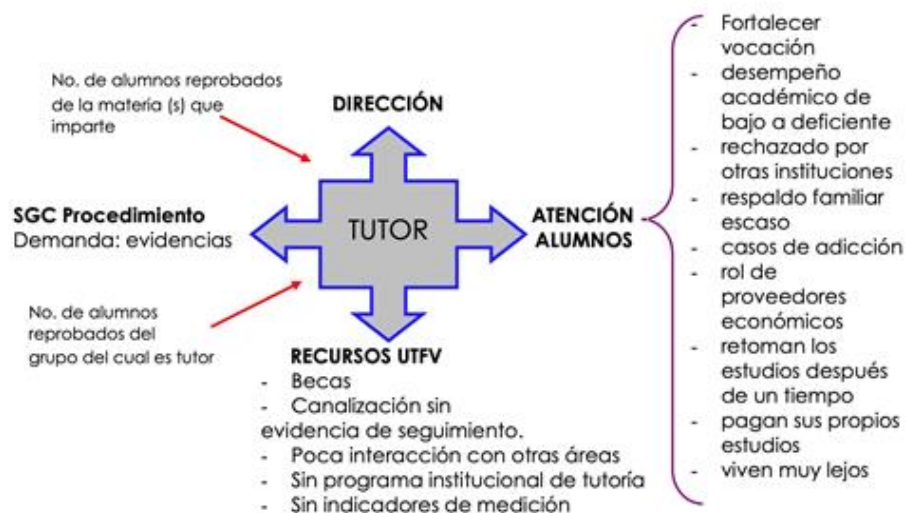
Aspectos	Descripción
Situación función de tutoría por división académica	Identificación del estado actual de la función de tutoría, utilidad, niveles, necesidades de intervención y priorización de indicadores de diagnóstico de RA de estudiantes, profesores y empleadores.
Definición consensada de la función de tutoría	Definición consensada de la función de tutoría, alineada con modelo educativo, modelo nacional de tutoría u organizaciones educativas como la ANUIES.
Acciones de atención al alumnado por grupo vulnerable	Con base en indicadores, clasificar a los estudiantes por atender, acciones por nivel de intervención y clasificación vulnerable.
Actividades sugeridas por grupo vulnerable (estudiantes)	Por clasificación vulnerable: Personal, académica y económica; se identifican y describen las actividades para planificar.
Actividades de reforzamiento (profesores)	Actividades para profesores basadas en las necesidades detectadas de servicio al estudiante.
Seguimiento del programa	Mecanismos para el seguimiento al programa.

Fuente: Elaboración propia

Once implemented, iterative feedback (cybersystemic) would allow making the necessary adjustments to achieve the objectives for each area of interaction (Academic Division) at different levels of the organization (student services). Below is a suggested example of each component aspect of a PROIGET.

Current situation of the tutoring function. Figure 6 shows an example of targeting the functions of the tutor applied to the case study with respect to the detection of needs of the population to be served.

Figura 6. Ejemplo de focalización de las funciones del tutor en la universidad



Fuente: Elaboración propia

Definition of tutoring. Based on the proposal of ANUIES (2001), it is stated that tutoring is a process of accompaniment during the training of students that is specified through personalized attention to a student or a small group of students by competent and trained academics. for this function, which are based on learning theories rather than teaching. The establishment of a tutoring process responds to a set of objectives related to the formative integration of the students, the feedback of the educational process, the motivation of the student, the development of skills for study and work, academic support and guidance, and especially with the graduation profile.

Actions of attention to students by vulnerable group. Table 2 shows some suggestions for classifying students by type of group (level of intervention) in correspondence with the possible actions to be implemented by vulnerable group.

Tabla 2. Clasificación de estudiantes por tipo de grupo, vulnerabilidad y acciones para implementar

Acciones	Tipo de grupo			
	Nuevo ingreso	Grupos en curso	Alumnos recursando	Estadía
Propedéutico	A			
Becas (seguimiento y/o canalización)	E	E	E	E
Servicios de salud (seguimiento y/o canalización)	P	P	P	P
Orientación psicológica (individual y/o grupal)	P	P	P	P
Identificación de nivel de conocimientos (evaluación diagnóstica)	A		A	
Talleres de aprendizaje	A	A	A	
Seminario de titulación				A
Orientación profesional	A	A	A	

A= Académico, E = Económico y P = Personal, corresponden a cada grupo vulnerable

Fuente: Elaboración propia

IV. Suggested activities by vulnerable group (students). For the personal social area (human development and integration) the following activities are suggested: 1) meeting with parents (by phase of student performance: new admission, from 2nd to 5th stay and recourse). Meetings with parents are intended to promote and strengthen joint monitoring of students' academic performance. It is based on the assumption that if the family members know about the university activity of the students, they will be in a position to follow up on the academic activities corresponding to the phase of student performance they support; 2) psychological orientation (group and individual). Provides individual and / or group support according to the needs detected by the tutors; 3) cultural and sports activities. Request to the corresponding instance, information on cultural and sports activities, as well as the importance of participation in them; 4) health services. Request for information to the instances about the times, services, requirements and functionality of these, which allows tutors to monitor and / or channel the students; 5) scheduling of general orientation workshops per quarterly level. The scheduling includes a series of group talks where students are guided, informed and given feedback on topics such as sexuality, gender, interpersonal relationships, values, communication skills, addictions, etc.

The activities depend on the diagnosis prior to the beginning of each semester and the academic level to which each group of students belongs. Table 3 shows a set of suggestions by academic level.

Tabla 3. Talleres generales por nivel cuatrimestral y tipo de estudiantes

Aspirantes	1.º	2.º	3.º	4.º	5.º
Orientación vocacional por carrera	-Vida universitaria. -Técnicas de estudio.	-Manejo de la adversidad. -Motivación.	-Salud sexual y reproductiva. -Adicciones.	-Los valores en la universidad. -Relaciones interpersonales.	-Competencias para el trabajo. -Elaboración de <i>currículum vitae</i> .

Fuente: Elaboración propia

For the academic area the following activities are suggested: 1) Basic academic leveling. Identification of the level of knowledge based on the examination applied by the Center of Evaluation for Higher Education (CENEVAL) for admission, to identify students with significant difficulties to take a preparatory course; for example: math, spelling workshop; 2) learning workshops (TA) (calendar is made). Groups of students who require reinforcement of specific knowledge derived from their AR, channeled by their tutors (design, mathematics, etc.), and who are not necessarily using it. It is a list of students that the tutor defines in conjunction with the teachers who teach the semester in question in order to level certain knowledge necessary to study the following semester and avoid recurring (except for those exceptions that do warrant it). The commitment that the student establishes with the division is made in writing to monitor the student's performance. The TAs are defined in two moments: a) when all the qualifications of the first partial or before are obtained, and b) when the teachers detect academic performance; 3) information needs: obtain the qualifications of the first term and meet with the tutor to define who would be able to take a TA. Deliver the lists of students in a timely manner (the dates have already been established) to detect the needs of time and availability of teachers to form the groups and publish them together with the class schedules; 4) quarterly academic conferences. Taught by professors and special guests to maintain and feed back the knowledge concerning the different professions, encouraging and strengthening the desire for study, as well as its continuity.

For the economic area the following activities are suggested: 1) student services. In coordination with the corresponding area, the projection of students who require financial support must be known through the cancellation of enrollment, granting of internal or external scholarships, etc .; 2) job bank. In coordination with the corresponding area, update and expand the requirements of internal and external human capital (neighboring municipalities, government organizations, businesses and local and regional companies).

Reinforcement activities (teachers). Based on a diagnosis of the teaching staff, assess the feasibility of correcting the weaknesses of training with respect to the needs detected in the diagnosis of students. Depending on this, the following general activities are suggested that should not replace a training program: 1) interdisciplinary projects (coordinating teachers). Definition of interdisciplinary projects for groups; 2) teacher training and updating program. It is generated from the needs of academic congruence with the knowledge of different professions to carry out the practical activities of the career and relevant to the profile of the graduate. This leads to defining academies; 3) institutional recognition of academies. Meeting of groups of teachers by areas of knowledge to review the study programs in order to promote the congruence of current knowledge with the curriculum. Generate subject manuals that allow defining the corresponding practices and congruent with the study plans and programs; 4) industrial projects. Meeting of full-time professors to define the projects and agree on the dynamics of project follow-up with the companies; 5) social service projects. Teachers meeting to define the dynamics to determine social service projects, duration, objectives, etc .; 6) mentoring circles. Meetings should be held with the tutor teachers to share tutoring experiences, define action plans to solve the difficulties that hinder the performance and permanence of the students, as well as the feedback of the pedagogical needs that help and contribute to solving academic problems with the students. students.

Monitoring of the mentoring program. Through the program report (physical or computerized), the planned four-month actions (per action, student, group and tutor) are monitored. The information and mentoring experience will serve to work in mentoring circles for teachers, and thus reinforce and take actions in relation to the needs of vulnerable groups.

So far, an example of an institutional tutoring program for its implementation in any HEI is shown in general, which must adapt to the educational model and align with the tutoring model indicated by each organization, as well as consider the current internal regulations. Once the PROIGET is integrated, it is suggested to carry out interactive planning (Ackoff,

2002), that is, in conjunction with the students and endorsed by directors, teachers and, where appropriate, by the entities that will intervene. An example of a PAST implementation of the case study is described below.

Systemic Tutorial Action Planning (PAST) based on diagnostic indicators

The PAST is a phase of PROIGET focused on student performance in the classroom. The action was organized with the information obtained from the diagnosis and feedback was given with the needs and qualifications subsequently collected from the students. A triangulation of the information collected from diagnostic instruments applied through interviews with students with academic difficulties and the evidence of academic work of the case study career direction was made. It should be clarified that in the case study there is no systematic and consistent academic evidence of the evaluation process by teachers who refer educational strategies (based on diagnoses, performance indicators, etc.), characteristics of evaluation instruments (individually the way of evaluating is defined, not precisely with evaluation instruments), delivery of academic programs to students, and verification that they are carried out. If a student reports disagreement in her evaluations, the management requests the professor in question to document the evaluation process to determine if there is any inconsistency.

Table 4 describes some diagnostic indicators with which the PAST is integrated in each study group indicated by MONTU-UTyP, classified into academic, personal and economic categories. With one hour a week integrated into the students' schedule and with their feedback, the use of a format was suggested to record the activities of the participating students by category.

Tabla 4. Integración de indicadores clasificados por grupo vulnerable

Académica	Personal	Económica
Criterios de evaluación.	Vocación.	Becas internas y externas.
Calificaciones parciales o continuas.	Plan de carrera.	Bolsa de trabajo.
Instrumentos de evaluación.		
Tiempo de estudio.		

Fuente: Elaboración propia

Table 5 shows the Activity Calendar Format (FOCA) organized for the three tutoring groups, after a sensitization session about the importance of accompaniment and the role of university tutoring.

Figura 7. Formato calendario de actividades por grupo y programa educativo

<i>Programa:</i> Nombre del programa educativo.		Hoja ____ de ____	
<i>Tutor:</i> Nombre del tutor.			
<i>Dimensión:</i> Académica.	<i>Grupo:</i> Nombre del grupo	<i>Total:</i> Alumnos inscritos	
<i>Actividades/fecha</i>			
Elaboración de CV	Fecha	Visita industrial	Fecha
<i>Redactar objetivo de la actividad</i>		<i>Redactar objetivo de la actividad</i>	
<i>Registro de estudiantes por actividad</i>			
Nombre y firma de cada estudiante...		Nombre y firma de cada estudiante...	

Fuente: Elaboración propia

The FOCA is a work tool with which the teacher plans activities and assistance based on the detection of indicators and students' needs. It was integrated with the information from the diagnosis and with the contrast of the classroom interaction experience and with what the students express. This planning must reach a point of agreement between the teacher and students; with this, the attendance record and the acceptance of each activity are organized. To be clear about the implementation of each activity, it is suggested that each one have an objective. The documentation of the management activities to achieve the objectives of each activity is attached to the FOCA created. For example, for the 5th semester group, the list of related companies was presented, a stay project carried out in a previous semester, the company data, and the tutor's work experiences were shared with the employers.

As a general recommendation for the application of this MATCITTU, iterative diagnoses should be carried out according to the school calendar or partial evaluations. For each diagnosis, a PAST must be generated and will have a temporality of application of the corresponding evaluation period. The PAST must be adjusted to the indicators generated in the diagnoses carried out, successively and progressively with new students and during their stay. (Reséndiz-Castro, 2021).

Discussion

This research is located in the educational field in general and in that of higher education in particular. The interest stems from detecting student dropout as a trigger for academic lag and the implication of the role of teacher and tutor of the researcher (Devereux, 2003). Shortly after, ANUIES (2001) defines lines of action with respect to what is considered an educational innovation: tutoring. In 2020, one more policy supports this function: the reference framework of the AC Engineering Teaching Accreditation Council (CACEI), which includes the assessment of school performance indices, institutional programs (counseling and tutoring), strategies that support the performance (school trajectory) and the retention and permanence of students (CACEI, 2020). Without the obligation of the HEIs to be certified and to adopt a student permanence program, they have different forms of tutoring services. Therefore, this study is pertinent and useful to systematize and transform the AR of the system, without bureaucracy, including the participation of the educational community to evaluate competencies (Martínez, Tobón & Romero, 2017).

The relationship of the tutoring context and its foundation CST potentiates its function and focuses organizational resources of each institution. In this relationship, tutoring is an integrating axis between students, teachers, organization and the labor field (Reséndiz-Castro, 2019). With this, it is assumed that the university has the challenge of diversifying educational training, based on the changes and needs that society requires to contribute to a balance in the quality of life (Rama, 2006). The MOTUI and MOGESICT models represent the relationship of the context as intervention guides; They show the relevance of teaching activity as a primary element of any educational system (Said-Hung, 2017). As an open system (Emery, 2004), the incorporation of the labor environment represented by the industrial sector allows building a certain sustainable and pertinent relationship, which according to Tobón (2013) supports the innovation of technical and professional socioformation to establish a context Balanced measurable at the local, regional and national levels. For Güemes-Castorena and Ponce-Jaramillo (2019), the symbiosis between university-collaborative company generates autopoiesis for research and development (R&D) and its inter-institutional link increases the capacities in science and technology necessary for social innovation.

The relevance of this framework lies in the way of systematizing student permanence, which can be verified with the work of Singh and Maloney (2019), where through measurements, in addition to optimizing the resources used to train human capital, it encourages job performance. This includes sport in its relationship with the RA. In this regard, Gracia (2020) shows a relationship for university permanence, identified between physical self-concept and AR, where self-concept serves as a scaffold for student integration (McGhie, 2017). Similarly, Valencia-Peris-Valencia, Devís-Devís and Peiró-Velert (2016) teach how students' knowledge of various sedentary activities is associated with its effect on academic success.

The Systemic Tutoring Action Planning (PAST) does little to transform the reality of students (Wiek et al. 2012) if there are no diagnostic mechanisms that systematize the information in the system. In the classification of MONTU-UTyP variables, although they are consistent with the literature, the indicators must be specified according to the operationalization in each institution. In this study, it was necessary to identify the operational importance of each indicator of the academic area, thereby encompassing key aspects of the teaching-learning process. In the case of evaluation criteria, they are conceived as a set of learning that students must achieve at the end of a period of work (Zabalza and Lodeiro, 2019), which falls within the teaching practice. With the above, partial or continuous qualifications are defined, as well as instruments to evaluate learning in each period. For Carvajal et al. (2017) teaching practice is a little-investigated student support, despite being considered as the cause of student dropout. Another indicator of the diagnosis was the ignorance of institutional norms, processes and regulations as a framework for teaching practice (Bayona, Oliveros and Saldarriaga, 2019), as well as the practice of accountability, reflected in evaluations without clear evidence by teachers. The organization of academic content (Rochin, 2021) and evaluation are essential to estimate the study time, including the resources to be used.

Regarding personal criteria, it encompasses aspects such as the vocation of the chosen career related to the AR of the students (Carvajal and Trejos, 2016) and the interests of the students. Zumárraga et al. (2017) have shown that vocation has a modest impact in the first levels of study and is intensified in the case of some careers. Regarding the economic variable, there is evidence of the need for students to work (Fleet and González, 2017). In

other cases, it is a dropout factor derived from the time spent studying (Herrero, Escanés & Ayllón, 2017).

As can be inferred, the absence of mechanisms to verify the management of student permanence in a sense of intervention should not be assumed as given, but as complex (Tobón, 2013). The monitoring of educational indicators is not a new issue, but their systematization is. This is an area of opportunity for identification, monitoring and measurement in online courses (Arnold and Campbell, 2013) and to predict student dropout (Tempelaar, Rienties, Mittelmeier and Nguyen, 2018), which can also be applicable to mixed modalities (online and in person) (Xing, Chen, Stein, y Marcinkowski, 2016).

Conclusions

The strategic framework of psychosocial intervention of the university tutoring function with a transdisciplinary cyber-systemic approach was based on diagnostic indicators of students, teachers and employers to favor the permanence of students. The function of university tutoring has represented, for a couple of decades, a unit of interconnection between the permanence of the student and the context of the educational system. The programs must contemplate a minimum methodological base based on the following: a) a foundation of university tutoring, b) models of comprehensive university tutoring and systemic management, c) a general institutional tutoring program and d) an action planning supported by its evidence, as well as its application, evaluation and feedback over time.

In this sense, and with the application of the Tutoring Systemic Action Plan (PAST), it was observed that, for the following semester, the percentage of student permanence of the newly admitted groups was 76.56%, that is, there was a retention of more than half of those students. However, in the following semesters (third, fourth and fifth) and at the beginning of the penultimate (before the stay) the program was not applied, so a retention of 33% was observed, which means that more was lost. than half of the students. University student permanence requires—in addition to an institutional tutoring, follow-up, monitoring and feedback program—the disposition of the authorities of each IES to focus decision-making and their organizational resources. In addition, a system requires defining the elements and functions of each one of them in a harmonious and coherent way, as well as their interactions between them and outside the system in a defined boundary. The implementation of the MATCITTU framework implies a commitment between authorities, teachers and employers

of each HEI. It is necessary to identify the needs of the students, the synergy of organizational work and, above all, to compensate areas of academic opportunity in charge of the managers. Teachers, therefore, must attend permanently and focused on students in their progress and difficulties to achieve the training of a competent professional committed to society.

Future lines of research

As future work, it is possible to deepen in the systematization of the diagnosis and its implementation, which would be very useful to generate educational profiles and create a set of educational strategies that allow successfully facing the challenge of student permanence.

References

- Ackoff, R. L. (2002). *El paradigma de Ackoff: una administración sistémica*. México: Limusa.
- Arnold, K. and Campbell, J. (2013). *System and method of using academic analytics of institutional data to improve student success*. Retrieved from <https://patentimages.storage.googleapis.com/8a/e4/9c/9e8b53b004a146/US8412736.pdf>
- Asociación Nacional de Universidades e Instituciones de Educación Superior [ANUIES] (2001). *La tutoría como una estrategia viable de mejoramiento de la calidad de la educación superior. Una propuesta de la ANUIES para su organización y funcionamiento en las instituciones de educación superior* (2.^a ed.). México: ANUIES. Recuperado de <http://www.uimgroo.edu.mx/Documentos/Tutorias/MANUALTUTORIAS-ANUIES.pdf>
- Bayona, L., Oliveros, S. y Saldarriaga, J. (2019). Conocimiento, interpretación y uso de las normas como forma de disminuir la deserción. *Congresos CLABES*. Recuperado de <https://revistas.utp.ac.pa/index.php/clabes/article/view/2675>.
- Cano, S. S. J. (2001). Rendimiento escolar y sus contextos. *Revista Complutense de Educación*, 12(1), 15-80. Recuperado de <https://revistas.ucm.es/index.php/RCED/article/view/RCED0101120015A/16836>
- Carvajal, O. P. y Trejos C. Á. (2016). Revisión de estudios sobre deserción estudiantil en educación superior en Latinoamérica bajo la perspectiva de Pierre

- Bourdieu. *Congresos CLABES*. Recuperado de <https://revistas.utp.ac.pa/index.php/clabes/article/view/1324>
- Carvajal, O. P., Trejos C. Á. A. y Gordillo, M. S. (2017). La práctica docente en la Universidad Tecnológica de Pereira analizada desde la perspectiva de sistemas blandos. *Congresos CLABES*. Recuperado de <https://revistas.utp.ac.pa/index.php/clabes/article/view/1567>
- Checkland, P. (2001). *Systems thinking, systems practice* (2.^a ed.). Londres: Wiley.
- Colmenares, A. M. (2012). Investigación-acción participativa: una metodología integradora del conocimiento y la acción. *Voces y Silencios. Revista Latinoamericana de Educación*, 3(1), 102-115. Recuperado de <https://dialnet.unirioja.es/servlet/articulo?codigo=4054232>
- Consejo de Acreditación de la Enseñanza de la Ingeniería [CACEI] (2020). *Marco de referencia 2020*. Recuperado de <http://cacei.org.mx/nvfs/nvfs02/nvfs0212.php>
- Devereux, G. (1994). *De la ansiedad al método en las ciencias del comportamiento*. México: Siglo XXI.
- Emery, M. (2004). Open Systems Theory. In Boonstra, J. J. (ed.), *Dynamics of Organizational Change and Learning* (pp. 43–69). UK: John Wiley and Sons: Chichester. Doi: <https://doi.org/10.1002/9780470753408.ch3>
- Esteve, J. M. (2003). Los modelos educativos de la sociedad contemporánea. En *La tercera revolución educativa* (pp. 123-151). España: Paidós.
- Fleet, A. y González, P. (2017). Beca laboral universidad de Chile. Mecanismo de formación del talento y retención académica. *Congresos CLABES*. Recuperado de <https://revistas.utp.ac.pa/index.php/clabes/article/view/1548>.
- Gibbs, P. (2017). *Transdisciplinary higher education: a theoretical basis revealed in practice*. Londres: Springer. Doi: 10.1007/978-3-319-56185-1
- Glasserman, M. L. D., Reséndiz, C. M. y Riquelme, O, J. (2010). Aprendizaje orientado a proyectos como apoyo para la integración de asignaturas en la formación profesional. *Apertura: Revista de Innovación Educativa*, 2(2), 6-17. Recuperado de <http://www.udgvirtual.udg.mx/apertura/index.php/apertura/article/view/137/152>
- Gracia, P. (2020). Autoconcepto físico, género y aprovechamiento escolar. Cambios en la transición a educación superior. En Roig-Vila, R. (coord.), *Redes de investigación e*

- innovación en docencia universitaria* (pp. 995-1002). Alicante, Universidad de Alicante.
- Güemes-Castorena, D. y Ponce-Jaramillo, E. (2019). University–Industry Linkage Framework to Identify Opportunity Areas. *Review of Policy Research*, 36, 660-682. Doi: <https://doi.org/10.1111/ropr.12355>
- Hammersley, M. y Atkinson, P. (2007). *Ethnography: Principles in practice*. Londres: Routledge.
- Hernández, S. R., Fernández, C. C. y Baptista, L. P. (2007). *Fundamentos de metodología de la investigación*. México: McGraw: Hill.
- Herrero, V., Escanés, G. y Ayllón, S. (2017). Importancia de la actividad laboral al momento de ingreso en el abandono en distintas modalidades de cursado. *Congresos CLABES*. Recuperado de <https://revistas.utp.ac.pa/index.php/clabes/article/view/1677>
- Hong, J., Zhu, R., Hou, B. and Wang, H. (2019). Academia-industry collaboration and regional innovation convergence in China. *Knowledge Management Research & Practice*, 17(4), 396-407. Doi: 10.1080/14778238.2019.1589394
- Ison, R. (2008). System thinking and practice for Action research. In Reason, P. and Bradbury, H. (eds.), *Action research: Participative inquiry and practice* (pp. 139-158). Londres: Sage.
- Ison, R. (2011). Cybersystemic conviviality: addressing the conundrum of ecosystems services. *Cybernetics and Human Knowing*, 18(1-2) pp. 135-141.
- Ison, R. and Blackmore, C. (2014). Designing and developing a reflexive learning system for managing systemic change. *Systems*, 2(2), 119-136. Doi: 10.1108/03684920710827346
- Martínez, I. J. E., Tobón, S. y Romero S. A. (2017). Problemáticas relacionadas con la acreditación de la calidad de la educación superior en América Latina. *Innovación Educativa*, 17(73), 79-96. Recuperado de http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1665-26732017000100079
- McGhie, V. (2017). Entering university studies: identifying enabling factors for a successful transition from school to university. *HigherEducation*, 3(73), 407–422. Doi: 10.1007/s10734-016-0100-2

- Munizaga, M. F., Cifuentes, O. M. y Beltrán, G. A. (2017). Variables y factores asociados al fenómeno de la retención y abandono estudiantil universitario en investigaciones de Latinoamérica y el Caribe. *Congresos CLABES*. Recuperado de <http://revistas.utp.ac.pa/index.php/clabes/article/view/1671/2407>
- Press, C. U. (2015). *Cambridge Dictionaries Online*.
- Rama, C. (2006). La tercera reforma de la educación superior en América Latina y el Caribe: masificación, regulaciones e internacionalización. *Revista Educación y Pedagogía*, 18(46), 11-24. Recuperado de <http://www.ub.edu/histodidactica/images/documentos/pdf/ESuperior%20en%20AMERICA%20LATINA.pdf>
- Reséndiz, C. M., Téllez, V. S. y Quintero, H. C. (2013). Estudio de requerimientos y especificaciones técnicas del sistema de impresión serigráfico para la industria gráfica del área de influencia a la UT. En Rojas, I. (ed.), *Mejores prácticas de la gestión de procesos de manufactura, experiencias de investigación* (pp. 60-66). Querétaro, México: Tercer Escalón. Recuperado de <https://www.bibliotechnia.com.mx/portal/visor/web/visor.php>
- Reséndiz-Castro, M. (2019). Cibersistémica transdisciplinaria: intervención integral de tutoría. En Universidad Autónoma de San Luis Potosí (ed.), *Innovación para la permanencia con equidad educativa: articulación institucional de programas en apoyo a la permanencia escolar* (pp. 810-814). México: UASL- ANUIES.
- Reséndiz C., M. (2021). *Marco de trabajo cibersistémico transdisciplinario para mejorar el rendimiento académico de nivel educativo superior* (tesis doctoral). SEPI ESIME Zacatenco IPN, México.
- Reséndiz-Castro, M., Peón-Escalante, I. E. y Zepeda-Bautista, R. (2018). Aproximación metodológica cibersistémica transdisciplinaria al campo de la educación superior. En Sebastián, D. (coord.), *XVII Congreso Nacional de Ingeniería Electromecánica y de Sistemas* (CNIES 2018). México: IPN.
- Rochin, B. F. L. (2021). Deserción escolar en la educación superior en México: revisión de literatura. *RIDE*, 11(22). Doi: <https://doi.org/10.23913/ride.v11i22.821>
- Rodrigues, B. C. (1977). El método Paulo Freire para la alfabetización de adultos. *Cuaderno del Centro de Cooperación Regional para la educación de adultos en América Latina y el Caribe* (CREFAL 3). Recuperado de

https://www.crefal.org/index.php?option=com_content&view=article&id=173&Itemid=225

- Romo, L. A. (2011). *La tutoría*. México: Anuies. Recuperado de <http://publicaciones.anuies.mx/pdfs/libros/Libro225.pdf>
- Ronde, P. and Hussler, C. (2005). Innovation in regions: What does really matter? *Research Policy*, 34(8), 1150–1172. Doi: <https://doi.org/10.1016/j.respol.2005.03.011>
- Said-Hung, E. (2017). Factores socioeducativos e institucionales asociados a la permanencia de los estudiantes de educación superior en línea caso UNIR-México. *Congresos CLABES*. Recuperado de <https://revistas.utp.ac.pa/index.php/clabes/article/view/1664>
- Singh, K. and Maloney, T. (2019) Using validated measures of high school academic achievement to predict university success. *New Zealand Economic Papers*, (53), 89-106. Doi: <https://doi.org/10.1080/00779954.2017.1419502>
- Stake, R. (1998). *Investigación con estudio de casos*. Madrid: Morata.
- Strauss, A. y Corbin, J. (2002). *Bases de la investigación cualitativa: técnicas y procedimientos para desarrollar la teoría fundamentada*. Colombia: Universidad de Antioquia. Recuperado de <https://diversidadlocal.files.wordpress.com/2012/09/bases-investigacion-cualitativa.pdf>
- Tempelaar, D., Rienties, B., Mittelmeier, J. and Nguyen, Q. (2018). Student profiling in a dispositional learning analytics application using formative assessment. *Computers in Human Behavior*, 78. Doi: <http://dx.doi.org/10.1016/j.chb.2017.08.010>
- Tobón, S. (2013). *Formación integral y competencias. Pensamiento complejo, currículo, didáctica y evaluación* (4.^a ed.). Bogotá: ECOE. Recuperado de https://issuu.com/cife/docs/libro_formacion_integral_y_competen
- Torres, G. J., Acevedo, C. D. y Gallo, G. L. (2016). Causas y consecuencias de la deserción y repitencia escolar: una visión general en el contexto latinoamericano. *Cultura Educación y Sociedad*, 6(2). Recuperado de <https://revistascientificas.cuc.edu.co/culturaeducacionysociedad/article/view/904>
- Valencia-Peris, A., Devís-Devís, J. and Peiró-Velert, C. (2016). Involvement in sedentary activities and academic performance in adolescents: Differences according to

- sociodemographic variables. *Cultura y Educación*, 28(2), 301-327. Doi: <https://doi.org/10.1080/11356405.2016.1158451>
- Wiek, A., Ness, B., Schweizer-Ries, P., Brand, F. S. and Farioli, F. (2012). From complex systems analysis to transformational change: a comparative appraisal of sustainability science projects. *Sustainability Science*, 7(S1), 5-24. Doi: 10.1007/s11625-011-0148-y
- Wilber, K. (2001). *A brief history of everything*. Boston, Massachusetts: Shambhala Publications.
- Xing, W., Chen, X., Stein, J. and Marcinkowski, M. (2016). Temporal predication of dropouts in MOOCs: Reaching the low hanging fruit through stacking generalization. *Computers in Human Behavior*, 58, 119-129. Doi: <http://dx.doi.org/10.1016/j.chb.2015.12.007>
- Zabalza, B. M. A. y Lodeiro, E. L. (2019). El desafío de evaluar por competencias en la universidad. *Revista Iberoamericana de Evaluación Educativa*, 12(2), 29-47. Doi: 10.15366/riee2019.12.2
- Zumárraga, M., Castro, M., Romero, J., Escobar, P., Boada, M., Armas, R., Luzuriaga, J. y Gonzáles, Y. (2017). Medición de intereses profesionales en estudiantes universitarios y un abordaje exploratorio de su relación con el desempeño académico. *Congresos CLABES*. Recuperado de <https://revistas.utp.ac.pa/index.php/clabes/article/view/1621>

Rol de Contribución	Definición (solo poner nombre del autor)
Conceptualización	Matilde Reséndiz-Castro
Metodología	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (igual)
Software	(No aplica)
Validación	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (apoya)
Análisis Formal	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (apoya)
Investigación	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (igual)
Recursos	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (igual)
Curación de datos	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (apoya)
Escritura - Preparación del borrador original	Matilde Reséndiz-Castro
Escritura - Revisión y edición	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (apoya)
Visualización	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (apoya)
Supervisión	Rosalba Zepeda-Bautista (principal) Matilde Reséndiz-Castro (igual)
Administración de Proyectos	Matilde Reséndiz-Castro (principal) Rosalba Zepeda-Bautista (igual)
Adquisición de fondos	Rosalba Zepeda-Bautista (principal) Matilde Reséndiz-Castro (igual)