

Technological platform for online assessment and report generation of school engagement and contextual factors: Brief technical report

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Abstract

This technical report describes a web-based platform for assessing school engagement in its three dimensions (emotional, behavioural and cognitive) and the contextual variables which influence engagement (family, teachers and peers). Students answer two questionnaires through the platform. Results are shown online through individual reports on students for teachers and psychosocial support teams, as well as the pupils themselves and their parents or guardians; it also provides aggregate reports by grade and school for teachers, psychosocial teams and school managers to assist in making contextualized and informed decisions.

The technological platform for assessing school engagement was developed in Chile. It is based on specially designed and psychometrically validated instruments for measuring school engagement and contextual factors, and on a tool for predictive modelling of student behaviour and contextual factors. The platform is currently being adjusted and tested for use in other Ibero-American countries (Peru, Uruguay, Colombia and Spain).

Keywords: Web based platform, school engagement, contextual factors, educational trajectories, online evaluation.

Resumen

Este reporte técnico describe una plataforma en base web de evaluación del compromiso escolar en sus tres dimensiones: compromiso afectivo, compromiso conductual y compromiso cognitivo; así como la valoración de factores contextuales que inciden sobre el mismo (familia, profesorado y pares). Los estudiantes responden dos cuestionarios a través de la plataforma. Los resultados son presentados online a través de reportes individuales de los estudiantes, los cuales son dirigidos a profesores y equipos psicosociales de apoyo también a apoderados y estudiantes, así como reportes agregados a nivel del curso y establecimiento escolares dirigidos para profesores y equipos de gestión y sostenedores de manera de facilitar la toma de decisiones contextualizadas e informadas.

La plataforma tecnológica de evaluación del compromiso escolar fue desarrollada en Chile, se basó en el diseño y validación psicométrica de los instrumentos de compromiso escolar y factores contextuales, así como en la modelización del efecto del compromiso escolar sobre la asistencia a clases y el rendimiento escolar. La plataforma se encuentra actualmente en proceso de ajuste y prueba para ser utilizada en otros países de Iberoamérica.

Palabras Clave: Plataforma de base web, compromiso escolar, factores contextuales, trayectorias educativas, evaluación en línea.

Introduction

School engagement motivates the student to learn. Various researchers (Appleton, Christenson, and Furlong 2008; Bowles et al., 2013; Fredricks, Blumenfeld, and Paris, 2004, Jimerson, Egeland, Sroufe, and Carlson, 2000; Lyche, 2010) agree that school engagement is a key variable in school drop-out rates, since dropping out of school is not usually an unpremeditated act but the final stage of a dynamic, cumulative process in which the pupil loses the engagement to study (Rumberger, 2001). On the other hand, when students develop a positive school engagement, they are more likely to graduate with low levels of behavioural risk and high academic performance, promoting successful educational trajectories.

In this report, a platform is presented, which seeks to provide information that can be used to ensure that students achieve twelve years of compulsory schooling (as is the case in Chile). A problem that adversely affect students' educational trajectories is the dropout rate, that reaches 10% in the case of secondary education in Chile (CEPAL, 2015). This educational exclusion is even more pronounced in Latin America, where, despite the efforts of public education policies, trajectories are characterized by a wide gap in terms of socio-educational equity. The most recurrent problems are associated with different forms of educational exclusion such as repetition, absenteeism, low academic performance, lack of family involvement or school engagement, whose final milestone is school dropout.

Given the relevance of school engagement to the permanence of students in school and the absence of instruments and a procedure to assess it, tools that measure school engagement and contextual factors that affect it were adapted and developed. These instruments, psychometrically validated for application to 7th and 8th grade elementary students and 1st grade secondary students in the Chilean education system, were included in a platform that allows their application and the viewing of the results.

The platform is based on the positive results (Miranda-Zapata et al., 2018) that validate the theoretical model that directly links *contextual factors (family, teachers and peers)* to school engagement (*emotional, cognitive and behavioural*), and school engagement to academic performance and attendance. It also confirms the mediating role of school engagement in

relation to the influence of *contextual factors* on the academic performance and attendance variables in students in 7th grade elementary (corresponding to 1st year of OSE), 8th grade elementary (corresponding to 2nd year of OSE) and 1st year secondary (corresponding to 3rd year of OSE) in municipal schools (Authors, 2018).

The platform functions online to make the information available remotely, so students can complete the instruments online at school. The information provided is processed by an algorithm (validated prototype) which automatically generates reports with results both at the individual level for students and teachers, and reports aggregated by grade and school for school management users to assist in local decision-making.

Conceptual information

In this online assessment platform, school engagement is conceptualised as the student's active participation in academic, curricular and extracurricular activities. It is assumed that engaged students will consider that their learning is significant and will be motivated and dedicated to their learning and their future. School engagement motivates students to learn; any student can be engaged, and the degree of engagement is considered to be strongly influenced by contextual factors, such as family, teachers and peers.

Because school engagement is an important predictor of educational performance, the use of a computerised platform to collect valid, reliable information and generate reports automatically will benefit both schools and government organisations (Fall and Roberts, 2012). The online assessment platform therefore presents at least three potential uses: a) Identifying students at risk of dropping out, b) Analysing students' interest in their studies at the period of transition from primary to secondary education, and c) Carrying out longitudinal monitoring of the school trajectories of all students.

School engagement is a multidimensional construct with three main dimensions: emotional, behavioural and cognitive components (Christenson, Reschly, and Wylie, 2012; Fredricks, et al., 2004; Fredricks, Filsecker, and Lawson, 2016; González, 2010); the online assessment platform conceptualises these three dimensions as follows (Miranda-Zapata et al., 2018):

- Emotional engagement: is defined as the level of the student's emotional response to the school and his/her learning process, characterised by a sense of involvement and by considering school to be a valuable place. Emotional engagement provides the incentive to participate and persevere. Students who are emotionally engaged feel part of the school community, and that school is significant in their lives, recognising that it provides them with tools with which to attain achievements in the outside world. It includes reactions to the teachers, classmates and the school. It is assumed to create a link with the school and a positive disposition towards school work.

- Behavioural engagement: is based on the idea of participation in the academic area and in social or extracurricular activities. The behavioural component of school engagement includes the student's interactions and responses in the classroom, the school and extracurricular environments. This aspect of school engagement is measured on a continuum, i.e. from the involvement expected universally (daily attendance) to more intense involvement (e.g. Participation in the Student Centre).

- Cognitive engagement: is based on the idea of psychological involvement in studying; it incorporates the awareness and willingness to make the effort needed to understand complex ideas and develop difficult skills. It is the conscious investment of energy to construct complex learning which goes beyond the minimum required. It reflects the student's willingness to use and develop cognitive skills in the learning process and in mastering new and highly complex skills. It implies acting reflexively and being willing to make the effort required to understand complex ideas and develop learning skills.

School engagement is strongly influenced by contextual and relational factors, such as family, the school and peers. All these factors can be moulded by intervention, so long as information is available on how they are affecting student engagement. For the purposes of the school assessment platform, three contextual factors were considered which may influence the pupil's educational career and commitment (Miranda-Zapata et al., 2018):

- Family. This refers to the students' perception that they are supported by their families. It includes activities like conversations with the child about his/her school day, help

with homework, creation of a space and time to study in the home.

- **Teachers.** This refers to the students' perception that they are supported by their teachers. The pupil feels motivated to learn by his/her teachers, and that they will help out with any problems. The pupil generally maintains good relations with the teachers. The pupil has the impression that the teachers are interested in him/her as a person and as a pupil, helping in case of difficulties.

- **Peers.** This is defined as the students' perception of their interpersonal relations with their classmates – the concern, trust and support existing between peers. These are important aspects for integration in the school and in dealing with academic challenges and/or difficulties.

Material and method

Technological architecture

The two questionnaires included in the platform are:

- *School engagement* questionnaire: Questionnaire created by Lara et al. (2018). Consisting of 29 items on a 5-point Likert scale, designed to evaluate the three types of SE: *Emotional engagement* (10 items), *cognitive engagement* (12 items) and *behavioural engagement* (7 items). There is evidence in favour of the structural validity, and the model has good levels of fit to the data ($\text{Chi}^2 = 548.52$; $\text{df} = 374$; $\text{RMSEA} = .045$; $\text{CFI} = .939$; $\text{TLI} = .934$) and good levels of reliability through the ordinal alpha coefficient for each of the subscales (.83 for *emotional engagement*, .86 for *behavioural engagement*, and .87 for *cognitive engagement*), as well as for the total scale (.95).
- *Contextual factors* questionnaire: Questionnaire registered by the Universidad de la Frontera and the Universidad Autónoma de Chile (2016) consisting of 18 items on a 5-point Likert scale aimed at assessing the *contextual factors: Family* (3 items), *teachers* (8 items) and *peers* (7 items). There is evidence in favour of the structural validity, with acceptable levels of fit of the model to the data ($\text{Chi}^2 = 263.01$; $\text{df} = 132$; $\text{RMSEA} = .070$; $\text{CFI} = .922$; $\text{TLI} = .911$) and suitable

levels of reliability, with Cronbach's alpha values of .69 for *family*, .83 for *teachers* and .83 for *peers*, while the reliability of the total scale is .88. (Authors, 2018).

In order to obtain functions and information at different levels – students, teachers, and schools– we sought to create a web-based technological solution which would allow integrated functioning of all user profiles. In particular, the web platform depends on a three-tier architecture:

- User level, consisting of the environment for user access to platform modules, through the use of an internet navigator. The user application for access to the assessment instruments and the reports module is executed in an internet navigator installed in the computer used for access, preferably Chrome or Firefox.
- Applications level, consisting of a server in which the various modules for authentication, assessment instruments and individual and group reports are installed. The online assessment instruments were developed based on the Lime Survey technology, which uses the Yii (PHP) development framework. The modules for viewing the results reports were developed using HTML, JavaScript, CSS and PHP.
- Data level, consisting of the database in which are stored the records of the pupils, involved in the assessment process, and the profiles associated with platform management. The database was created in the MySQL motor, installed in the central server. It is a high-performance programme (24/7) available in the cloud under the Linux operating system through a Web Apache server.

The platform has been designed according to the specific requirements of the school engagement project and educational trajectories, considering usability for the students that respond to the instrument, data security for the research team that analyzes the data, reliability of results, pragmatism of reports generated by the platform for the visualization and correct reading of the results.

The innovation of this platform is the simplicity of the presentation graph and its usability, together with the possibility of accessing remotely from anywhere in the world. It is

enabled to be used in different educational geographic contexts since the measuring instrument is adapted to the language of each country. It is a self-managing platform that allows the management of the different users that use the tool in order to guarantee the confidentiality of the data associated with the students.

The platform is ready to be used from different devices, whether these are conventional computers or mobile devices. Currently the experience that has been with the different schools analyzed is to use the platform from computers (desktop and laptop) belonging to schools that are mostly in computer labs connected to an Internet network. The platform, because it is simple in terms of its graphics, works with one of the simplest internet connections, since it does not require high levels of connection performance.

The user profiles with access to the reports module are teachers, schools and educational local governments. Reports are presented in graphic, interactive form in the internet navigator, and also include a version in a PDF file which can be down-loaded and viewed without necessarily being connected to the internet.

Platform Description

Technological platform modules

The technological platform for assessing school engagement and contextual factors is a web-based system available at <http://www.compromisoescolar.cl/>.

As Figure 1 shows, the user logs onto the platform using a password previously created and assigned by the platform administration. Depending on the user profile of the code assigned, users have access to certain functions in the software modules, i.e.:



Figure 1. *Technological platform*

Survey application module

The survey module is an environment in which students have access to the surveys form. They fill in the survey, and the software then assesses the student's engagement and the relevant contextual factors.

In particular, this module includes an authentication function through a previously assigned password to allow access to the survey by the student users.

The pupil enters using the password assigned, generally his/her national ID number. The survey starts with a Welcome page, to motivate the pupil to complete the survey. When the pupil clicks on Start, a series of 12 screens are presented, with 6 items each. The pupil must select the response to each item which matches his/her personal situation most closely (Figure 2).



Figure 2. *Students surveys*

As shown in Figure 2, to facilitate interaction with the survey each screen includes: instructions which can be exposed or hidden; a progress bar which shows the user how far he/she has advanced in the survey (in %); buttons for navigating through the survey screens. The survey also includes visual information about each of the response options to help the pupil to choose. To ensure that the students' answers to the surveys are complete, there is a function which prevents them from moving on to the next screen unless they have answered all the items. When they have completed and submitted the survey, the pupils will have access to a participation diploma which can be downloaded in PDF and printed or sent to an e-mail address.

Assessment Reports module

To facilitate analysis and interpretation of the results generated by the survey, a reports module has been developed which shows information associated with the assessment individually and aggregated by grade, school and group of schools in graphic form. The module is opened by clicking on a button at the bottom of the survey website, or directly at the address: <http://www.compromisoescolar.cl/reportes/>. Access to this reports module is restricted and only authorised users can log on using a password created by the platform administration.

Teacher reports

In this module the teacher has access to the individual reports of the students and the group reports of the courses for which he/she is Course Teacher.

The individual reports consist of a set of qualitative characterisations associated with the scores obtained by each pupil for school engagement and contextual factors. As Figure 3 shows, the teacher and/or the psychosocial or psychoeducational support team (according to the definition of the school management team) logs onto the module and selects the option *Students* in the menu on the left-hand side. The users can then select the pupil whose results they wish to view. The system will present a set of *Strengths* and *Alerts* associated with each dimension of student engagement and contextual factors, which include a set of qualitative characterisations associated with each pupil. The pupils' individual scores are never shown, nor are they classified or categorised in any way, not even to divide pupils into high, medium and low school engagement.

What the software does is to identify important information on the principal strengths and alerts for each student, thus allowing specific guidance to be given to promote the development of student engagement or to address the predictive factors affecting involvement, particularly contextual or relational, from the perspective of strengths.

A report in PDF format can be downloaded and printed for viewing.

Technological platform for online assessment and report generation of school engagement and contextual factors:
Brief technical report

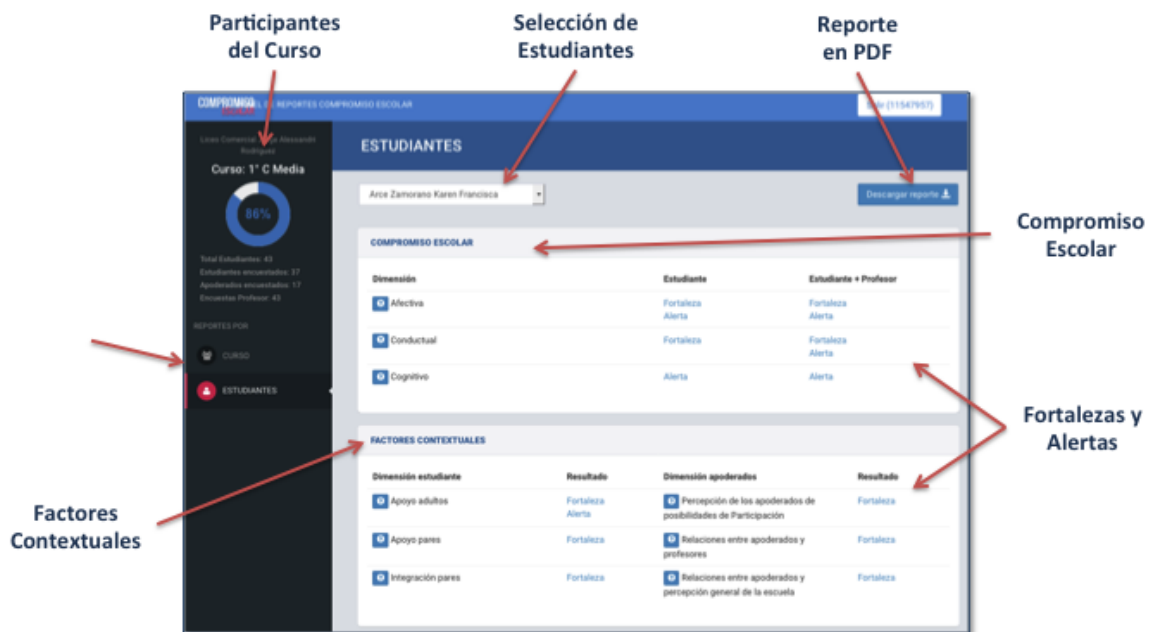


Figure 3. Student Report

The grade reports module available to teachers and psychosocial or psychoeducational support teams include four reports: Gap, Distribution of responses to items, Development levels and Dispersion levels among course pupils, without identifying the students (Figure 4).



Figure 4. *Grade Reports*

The Gaps report is a spider chart showing the mean values obtained by the students in a grade for behavioural, cognitive and affective commitment, and the difference compared to the maximum possible (Gap).

The Distribution Report shows the percentage distribution of response options marked by pupils for each of the three dimensions of school engagement and contextual factors. To view the information the teacher selects first the variable to be analysed and then the dimension for which the response distribution is required.

The Development Levels Report uses a graph to show the percentage of pupils in each of four development levels of school engagement and contextual factors, based on the values obtained by each pupil for each dimension. The cut-off scores for each of the four levels were defined by the design team, based on a theoretical division of the range between the maximum and minimum values on the scale.

The Dispersion Report is a quadrant graph representing the conjugation of school engagement scores (Y axis) and contextual factor scores (X axis) as XY coordinates. Each point stands for a pupil in the course. The graph not only shows the scores obtained from the students' responses, but also complements their answers with the input of their parents/guardians and teachers. This allows the distance between self-perception and the perception of others to be shown graphically.

Reports for school use

The reports module shows information available to the management team of participating schools, including reports at both course and school level. These reports may be important material for diagnosis, monitoring or assessment by management teams, UTP (Technical Teaching Unit) managers and/or psychosocial or psychoeducational support teams, facilitating prompt local decision-making.

The information is presented in the same formats as are available to teachers (Figure 4). However, the management team is able to see the report of any course in the school by selecting first the course from a pop-up menu and then the type of report: Gap, Distribution of responses, Development and Dispersion (Figure 5).

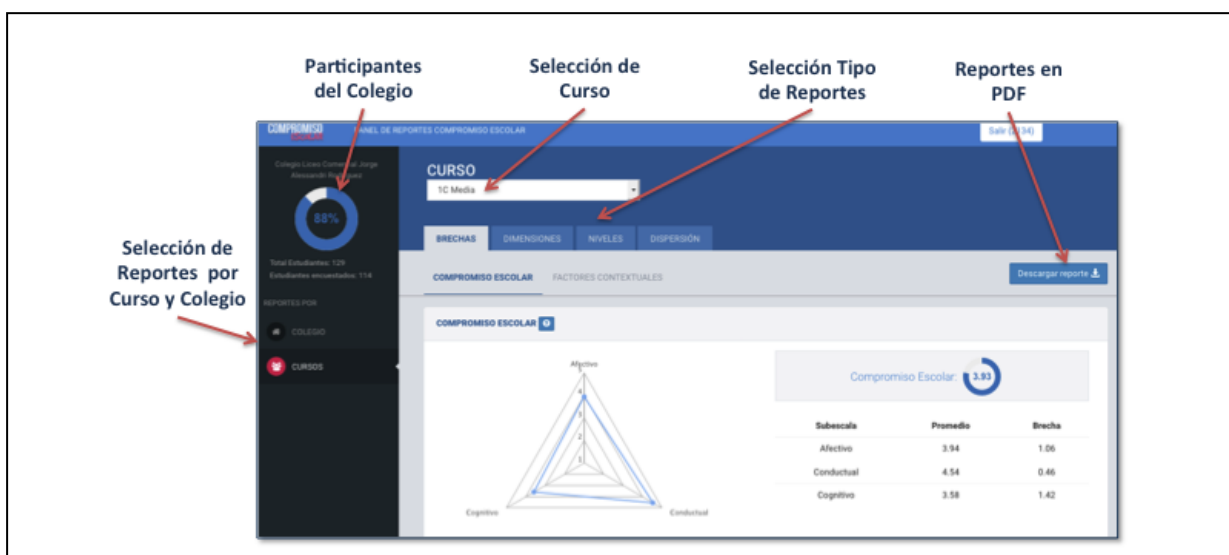


Figure 5. *Reports for school use*

This user profile is also authorised to see the same reports but with mean values for the whole school. In this case each point in the Dispersion graph represents the mean value of a course. This information allows the management team to obtain a general panorama of the different courses, and how they fit into the overall panorama of the school.

Reports for the Educational Local Government

Those educational local government who administer a group of schools can use the reports module to view the same information available to school management for each individual school, and also the overall values for all the schools in the group. As in the school level reports, the data are presented in the same formats available to teachers (Figure 4). In this case however the mean values of the pupils in a given school are available, as well as the overall values for all the schools administered by the *educational local government*.

The *educational local government* user selects an individual school using the pop-up menu, and then the type of report required: Gap, Distribution of responses, Development and Dispersion (Figure 6). Thus this user profile can see the same reports but with the mean values for each school and for the whole group of schools administered by the *educational local government*.

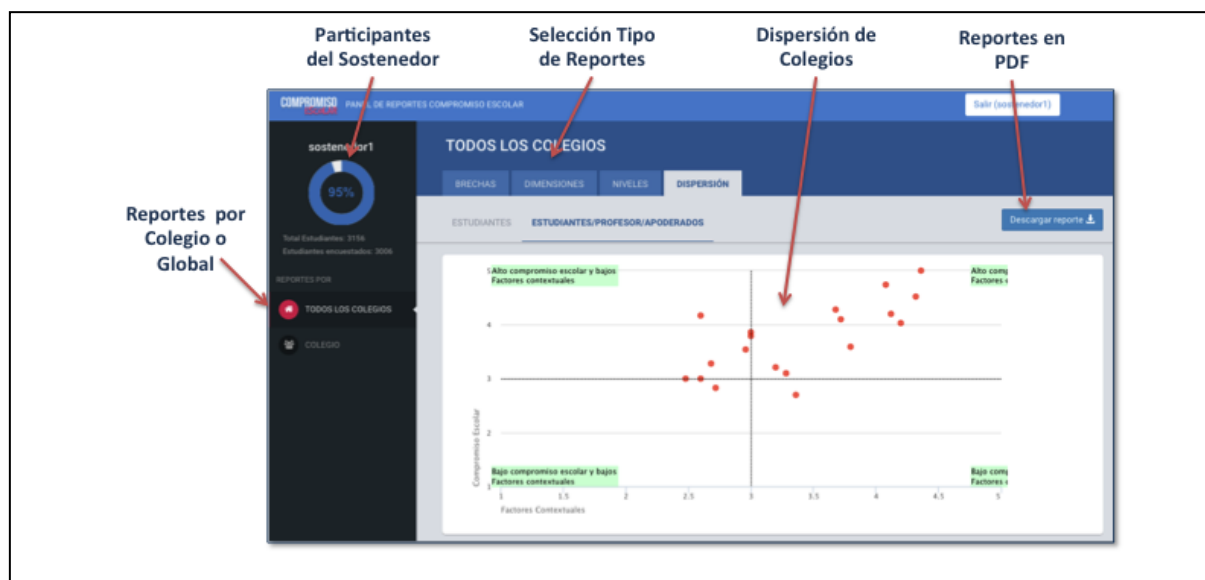


Figure 6. Reports for the Educational Local Government

In this case, each point in the dispersion graph for the group represents the mean value for a school. This information allows the management team to obtain a general panorama of the different schools in the group and their part in the overall panorama of the group.

Discussion

School Engagement is considered a fundamental concept to both understand the phenomenon of dropping out and to promote successful educational trajectories (Christenson, Reschly, Appleton, Berman-Young, Spanjers, and Varro, 2008). The situation in Chile is consistent with this finding, since school engagement is a variable which presents a real effect on attendance rates and academic performance (Miranda-Zapata et al., 2018).

The school engagement assessment platform presented in this report allows school engagement to be assessed in students between 7th grade elementary and 1st grade secondary in the Chilean education system. It can be applied quickly and collectively, is user-friendly and easily scalable. Application takes approximately 20 minutes on average for students in 1st grade secondary and 40 minutes for students in 7th grade primary. It provides important information related with the risk of students dropping out of school. Which can be used by teachers and managers to prevent it.

The platform presented is currently being improvement into a second version. There are some aspects that are being developed, among them, we highlight the need to implement some extra functionalities to the web platform, an extra module focused on pedagogical and social-educational practice, and increase the educational levels covered by the platform.

First, functionalities added to the web platform, have been based on making it more complete and easier to use such as: a registration module, longitudinal monitoring, reports of school engagement over time and a training module for teachers, assistants and psychoeducational support teams that allows them to facilitate the use of the platform as well as internalize the factors related to the school engagement and the importance of promoting it.

Second, a pedagogical and socio-educational practice support module providing information on strategies to promote school engagement that can be worked on in teacher meetings, meetings with parents as well as workshops with students. These guidelines are found

directly on the online platform for evaluation and monitoring of school engagement, as well as in a downloadable version of the manual on school engagement interventions. A manual of Intervention guidelines on school engagement can be found in: <https://ciencias.uautonoma.cl/manual-intervenciones> . This module will allow the manager of each school to upload documentation for teacher support, for example: slides, documents, audios and videos. Currently, the platform is developed and prepared to support the mp3, mp4, doc, pdf and ppt formats, which are generally used to generate documentation for future interventions that could be made in the classes/schools evaluated.

Third, the platform is being developed to cover earlier and later educational levels. By suggestion of the Ministry of Education of Chile, it was necessary to incorporate the functionality to apply the tool to children of earlier educational levels (5th and 6th grade students) in order to serve as an early alert system in order to prevent school dropouts and promote successful educational trajectories. Also, we incorporated 2nd and 3th grade secondary, to allow a longitudinal following of the student.

Finally, the platform was developed specifically for the situation in Chile, however an international transfer strategy can be highlighted. This strategy has involved conducting pilot tests of the school engagement evaluation platform and technical training sessions to the team that will be responsible for its operation and maintenance, with the aim to transfer the software and associated functional procedures. This has been done in four Ibero-American countries: Peru, Uruguay, Spain and Colombia. The main objective of this work has been to adapt the questionnaires linguistically and culturally for the Spanish-speaking populations of different countries, as well as executing the testing and validation of the online platform in these four countries considering the potential scalability for the Ibero-American population. The next challenge lies in the internationalization to Spanish-speaking populations from other countries beyond Latin America and Spain and later to countries whose main language is different from Spanish.

For further information please contact: info@compromisoescolar.cl.

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