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# Implementation of the 2012 upper secondary school curriculum in Mexico: a 21st-century framework enquiry

*Implementación del currículo 2012 de la escuela media superior en México: Una investigación con el marco de habilidades del siglo XXI*

*Implementação do currículo do ensino médio de 2012 no México: uma investigação com a estrutura de habilidades do século XXI*



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## Abstract:

**Objective.** This study aims to analyze how the new upper secondary school curriculum in Mexico captures 21st-century skills and teachers' perceptions of success. **Method.** The design of the study complies a comparison analysis between the Mexican upper secondary school curriculum and a 21st-century skills framework. Additionally, qualitative data on teachers' perceptions of success is collected through eight focus groups with 72 participants in 4 States of Mexico. **Results.** The findings show that the curriculum is short in strategies for the development of 21st-century skills. Moreover, although teachers welcome them, they perceive a lack of support and doubt about students' learning capabilities. **Conclusions.** Although Mexico has progressed in providing a 21st-century skills learning environment through the new curriculum, the educational system remains with the opportunity to offer a more suitable and adequate framework as well as support and training for teachers.

**Keywords:** Educational reform; skills; curriculum; teachers; Mexico.

## Resumen:

**Objetivo.** El estudio tiene como objetivo analizar cómo el nuevo currículo de educación media superior incluye habilidades del siglo XXI, así como las percepciones de éxito de los maestros y las maestras. **Método.** El diseño del estudio se realiza a partir de un análisis comparativo entre el currículo mexicano de la escuela media superior y un marco de habilidades del siglo XXI. Además, se recolectan datos cualitativos sobre las percepciones de éxito del personal docente a través de ocho grupos focales con un total de 72 participantes en 4 Estados de México. **Resultados.** Los resultados muestran que el currículo no tiene suficientes estrategias para el desarrollo de habilidades del siglo



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XXI. Además, aunque los maestros y las maestras las aprecian positivamente, perciben falta de apoyo y dudan sobre las capacidades de aprendizaje de sus estudiantes. **Conclusiones.** A pesar de que México ha progresado en proporcionar un ambiente de aprendizaje para las habilidades del siglo XXI a través de su nuevo currículo, el sistema educativo sigue teniendo como área de oportunidad el ofrecer un marco más completo y adecuado, así como capacitación y acompañamiento a sus docentes.

**Palabras claves:** Reforma educativa; habilidades; plan de estudios; maestros y maestras; México.

#### Resumo:

**Objetivo.** O estudo tem como objetivo analisar como o novo currículo do ensino médio no México inclui as habilidades do século XXI, bem como as percepções de sucesso da equipe docente. **Método.** O desenho do estudo é realizado a partir de uma análise comparativa entre o currículo da escola secundária mexicana e uma estrutura de habilidades do século XXI. Além disso, dados qualitativos sobre as percepções de sucesso da equipe docente são coletados por meio de oito grupos focais, com um total de 72 participantes em 4 estados do México. **Resultados.** Os resultados demonstram que o currículo não possui suficientes estratégias de habilidades do século XXI. Além disso, embora a equipe docente as aprecie positivamente, percebem falta de apoio e dúvida das capacidades de aprendizado de seus estudantes. **Conclusões.** Apesar do México ter progredido em proporcionar um ambiente de aprendizado para as habilidades do século XXI por meio de seu novo currículo, o sistema educacional continua tendo como área de oportunidade fornecer uma estrutura mais completa e adequada, bem como treinamento e suporte para seus docentes.

**Palavras-chave:** Reforma educacional; habilidades; plano de estudos; docentes, México.

## Introduction

The globalized market now offers jobs that require more refined skills. Skills are defined as the abilities to perform a job well because of practise, also skills are described as abilities developed through training and experience that are useful in a job (Cambridge Dictionary, 2021, definition 1 & 3). Job applicants need to be prepared to be more flexible and show interpersonal and information and communication technology (ICT) skills rather than specialized knowledge (Ananiadou & Claro, 2009; Barrot, 2019). As a result, there is consensus that students in the modern world need a more balanced set of skills to succeed (Barrot, 2019; Marope et al., 2015). That set of skills are generally known as 21st-century skills (van de Oudeweetering & Voogt, 2018).

There is still insufficient agreement on “what works best” to enhance 21st-century skills in the education sector (Donovan et al., 2014; Tindowen et al., 2017), as well as what changes have to be done to foster the development of those skills within the curriculum. Notwithstanding, the literature shows agreement on how crucial it is to have two conditions in place to foster 21st-century skills: first, a school curriculum with not only 21st-century skills emphasis but with a detailed and balanced number of strategies to enhance the development of every skill (Law, 2014; Maphosa & Mashau, 2014). Secondly, teachers’ ability, involvement and support to

enhance them during lessons (van de Oudeweetering & Voogt, 2018). Research that reviews implementation of 21st-century skills in OCDE countries highlights that a major challenge for successful implementation is to align these conditions and have them in place at the same time (Bujanda et al., 2018; Voogt & Pareja Roblin, 2012).

This paper considers whether Mexico is ready to implement a 21st century framework at upper secondary school. This is relevant because the Mexican education system went through an Educational Reform in 2012 with special emphasis on 21st-century skills development (Hernández Fernández & Rubio de los Santos, 2017; Secretaría de Educación Pública, 2017b). Also because most of the research focuses on the implementation of 21st-century skills in the Netherlands (van de Oudeweetering & Voogt, 2018); Singapore (Tan et al., 2017), Philippines (Barrot, 2019; Tindowen et al., 2017), China (Law, 2014), the United States (Zhao, 2015) as well as EU member states and OECD countries (Ananiadou & Claro, 2009; Voogt & Pareja Roblin, 2012); while very little research is available for the cases of Latin American countries with the only exception of Costa Rica (Bujanda et al., 2018).

This research purports to answer two key questions. Question 1: Does the new upper secondary school curriculum in Mexico include relevant elements to enhance 21st-century skills development? Question 2: Do teachers believe they are capable to deliver these skills?

This article is structured as follows: first, I describe the Mexican Education Reform and the upper secondary school new curriculum emphasis on 21st-century skills development. Secondly, I present the importance of 21st-century skills, the characteristics and elements for its successful implementation and the framework used in the study. The third section describes the method. In the fifth section, I present the findings of the analysis. The last section presents a discussion of results.

## Policy Context

In 2012, Mexico started an Educational Reform with focus in the development of 21st-century skills. It included a new education model (NEM) and a new curriculum (NC) which had as main objectives to enable students to acquire the skills needed for the 21st-century (Secretaría de Educación Pública, 2017a, 2017b). The NEM and the NC have as foundation the model of deep learning, where teachers are encouraged to promote meaningful learning (Ortega Estrada, 2017).

The Ministry of Education openly stated that the reasons to change the curriculum were as follows: the previous curriculum focused more on teaching than on learning; it was very extensive and did not encourage students to develop ideas and concepts; it dismissed the learning needs of learners, did not offer comprehensive training, and focused only on academic subjects (Secretaría de Educación Pública, 2017a).



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The NC has four pedagogical approaches: deep learning, significant learning, situated learning and socio-emotional learning. At upper secondary school the NC includes a graduate profile as well as disciplinary plans. The graduate profile states 12 general aspects upper secondary students should accomplish: 1) Have a sense of belonging and love for Mexico. 2) Promote coexistence and dialogue, with respect for diversity. 3) Care and act for the environment. 4) Value art and culture. 5) Collaborate in a constructive way. 6) Communicate effectively. 7) Use digital skills. 8) Seek to understand his/her surroundings. 9) Think critically. 10) Reason and apply numerical concepts. 11) Know and understand basic financial aspects. 12) Regulate his/her emotions and take care of his/her health. With regards to the disciplinary plans the NC includes 5 knowledge areas: Mathematics, Experimental Sciences, Communication, Social Sciences, and Humanities ([Secretaría de Educación Pública, 2017a](#)). Each disciplinary plan includes a disaggregated learning strategy with a competence-based approach. Both aspects of the NC graduate profile and disciplinary plans are used in the analysis presented in this article.

## Conceptual Framework

Nowadays students face an information-based world, where the knowledge and skills to have a successful life are very different from the ones needed by previous generations ([Marope et al., 2015](#)). The job market demands problem-solving skills, teamwork abilities, efficient communication techniques as well as abilities to use information technologies ([Ananiadou & Claro, 2009](#); [Rotherham & Willingham, 2010](#)).

21st-century skills have been found to prepare students to overcome real-world challenges, stimulate their motivation and progression through education, follow healthy lifestyles and prevent engagement in aggressive behaviours ([OECD, 2015](#)) Therefore, education systems and their education policies should foster students' development of 21st-century skills ([Ananiadou & Claro, 2009](#); [Care, 2018](#)).

21st-century skills cannot be considered as independent learning: the curriculum, learning centres, teachers and everyone involved in the educational world, need to change to provide adequate planning and implementation ([Ananiadou & Claro, 2009](#)). [Voogt and Pareja \(2012\)](#) suggest the importance of having in place: a school curriculum with 21st-century skills emphasis and teachers' ability and involvement to enhance them in class, as well as the involvement of various public and private stakeholders in the implementation process. This highlights the need in aligning curriculum, teachers and stakeholders' contributions for successful implementation.

Additionally, research shows that 21st-century frameworks face the challenge of successfully translating into practical guidelines to be followed at schools and by teachers ([van de Oudeweetering & Voogt, 2018](#); [Voogt & Pareja Roblin, 2012](#)). One reason is the lack of liaison between such frameworks and schools' daily activities ([British Council, 2016](#); [Fullan](#)

& Langworthy, 2013; Marope et al., 2015; Vreeburg Izzo et al., 2010). With that respect, Barrot (2019) reviewed how the English curriculum in the Philippines contained 21st-century learning principles. The study also verified whether the curriculum contained teaching and learning principles by enquiring its specificity and coherence (Barrot, 2019). His findings show that the curriculum fails in providing guidelines to understand how themes can be converted into learning competencies and standards, which potentially affect teachers' implementation. The work suggests that amongst the elements to support successful implementation of 21st-century skills is to provide a curriculum with clear and explicit objectives, which includes strategies to develop all skill as well as balance in the number of strategies to develop each one equally.

Mishra & Mehta (2017) enquired teachers' and educators' understandings of 21st-century skills and knowledge. The findings show that teachers gave a different weight of importance to each 21st-century skill valuing some more than others. The findings show that educators' understandings significantly define curricula's enactment (Mishra & Mehta, 2017). With that regard evidence explains that teachers may find it difficult to integrate 21st-century frameworks into their instruction (Fernandez, 2013). For that reason, the curriculum needs to have the necessary strategies for implementation and a balanced set of pedagogical objectives (Barrot, 2019; Mishra & Mehta, 2017).

There is a vast set of 21st-century skills frameworks. The frameworks have been developed by international organizations such as the Organization for Economic Co-operation and Development (OECD) in 2005, the European Union (EU) in 2006 and the British Council (BC) in 2015; as well as commercial organizations including Partnership for Twenty-First Century Skills (P21) in 2015 and EnGauge in 2003 (van de Oudeweetering & Voogt, 2018). The conceptualizations and terminologies vary among actors and countries. Notwithstanding, there is certain level of agreement that core and critical areas for 21st-century skills development include: 1) collaboration and teamwork, 2) creativity and imagination, 3) critical thinking, and 4) problem solving (Ananiadou & Claro, 2009; Voogt & Pareja Roblin, 2012).

I explored the different 21st-century skills frameworks and decided to use the BC's Core Skills (CS) model because of three reasons: first, the CS model includes the main 21st-century skills: 1) Critical thinking and problem solving; 2) Collaboration and communication; 3) Creativity and imagination; 4) Citizenship; 5) Digital literacy; and 6) Student leadership and personal development. Second, the CS model is based on the deep pedagogic framework (Fullan & Langworthy, 2013) which is the foundation framework of the Mexican NC. In that way the comparison between the NC with the CS model is relevant. Third, I use the CS model because it includes strategies to implement 21st-century skills within curricula. Particularly, the CS model offers a balanced strategy that gives equal importance to each skill (British Council, 2016). Recent research has highlighted the value of providing a balanced approach to 21st-century skills development (Barrot, 2019). A balanced approach provides harmony in the strategies by giving equal importance to every knowledge domain (Mishra & Mehta, 2017).



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## Method

This article studies Mexico's readiness to implement 21st-century skills at upper secondary school. The research aims to answer two questions. Question 1: Does the new upper secondary school curriculum in Mexico includes relevant elements to enhance 21st-century skills development? Question 2: Do teachers believe they are capable to deliver these skills? The study is performed using an inductive qualitative analysis in two stages to answer each question respectively. To answer the first question, I perform desk-based research using the NC and CS model. I map if the NC provides a balanced strategy to enhance 21st-century skills development using the CS model as reference. In other words, I observe whether the NC includes strategies for the development 21st-century skills while at the same time giving equal importance to each of them. To study the second question, I performed focus groups to analyse primary information on teachers' perceptions on their own ability to deliver these skills. I use a data triangulation mechanism (Yin, 2017), in which I compare the results of the first analysis and contrast them with teachers' understandings and responses. This allows an in-depth understanding of the different meanings and contexts of the phenomenon (Quinn Patton, 2015) which are useful to elaborate conclusions on whether Mexico is ready for the implementation of 21st-century skills at upper secondary school.

### Mapping of the New Curriculum elements to enhance 21st-century skills

The analysis values how the curriculum succeeds in providing a balanced framework to develop 21st-century skills, as "balance" (Barrot, 2019) or "harmony" (Mishra & Mehta, 2017) is crucial for successful implementation. It is relevant to mention that I do not evaluate the quality of the curriculum, instead I value whether the curriculum provides a framework that specifically incorporates standards and strategies that support the development of each 21st-century skill in a balanced way (Barrot, 2019).

The methodology is as follows. I create matrices listing each of the NC aspects at upper secondary school: graduate profile descriptions and education plans descriptions by discipline: Mathematics, Experimental Sciences, Communication, Social Sciences, and Humanities to compare them with the CS model. To do so, I list the NC descriptions as rows at each matrix and use the CS categories as headings (columns). The analysis consists of observing whether each item of the NC corresponds, relates or answers the description of what has to be developed within the 21st-century skills CS model.

This methodology provides an analysis matrix with a weighted sum of values (Hernández Fernández & Rubio de los Santos, 2017). Each of the matrices are evaluated as a whole using a colour scale, where the areas with the highest value (i.e., the most balanced) are marked in "green". Likewise, the areas that have lowest values (i.e., the least balanced) are marked in "red". As such, there is a scale in between which shows three intermediate colours that go from lighter green, yellow and orange. The allocation of colours in the table is wholly based on the

weighted values at each matrix. In other words, neither the values themselves nor the assigned colours can be used as a means of comparison between the graduate profile and the different disciplines. Table 1 presents an example of the analysis.

**Table 1:** Example of the analysis for the graduate profile matrix\*

Graduate Profile	Critical Thinking and Problem solving	Collaboration and Communication	Creativity and Imagination	Citizenship	Digital Literacy	Student Leadership and Personal Development
Item 1	1	2	3	4	5	2
Item 2	2	1	4	3	2	1
Item 3	3	4	1	2	3	4

**Note:** Own elaboration. \*The values presented as an example show that the most balanced items are displayed in dark green, followed by light green, and yellow. The smallest values that represent lack of elements are displayed in orange and red.

**Data Analysis.** The analysis is completed when observing the whole matrix. Alignment is observed when a matrix is mostly green, which means that the NC includes a good deal of recommended strategies to develop the six areas of the CS. In the same way the matrix shows balance when the colours of the matrix are in the same range. Particularly, the matrix would show alignment and balance when as whole is in the range of greens (light and dark green) because it has a good number of CS strategies by item and the NC shows that it gives the same importance to all the areas included. Conversely, a matrix does not show alignment when has a good number of items in yellow, orange and red which suggest that there are not enough number of strategies in place to develop CS. Additionally, a matrix does not show balance when it has a mix of colours, as it means that some areas have more strategies than others in place to foster 21st-century skills. I created a total of 6 matrices for the analysis of the upper secondary school NC. The first matrix includes the comparison between the graduate profile with the CS framework. Moreover, I created 5 matrices for the comparison between the upper secondary school disciplinary plans with the CS framework; one per area knowledge: Mathematics, Experimental Sciences, Communication, Social Sciences, and Humanities. For clarity purposes I present in this article the matrix with the results of the comparison between the graduate profile with the CS framework. To present the results of the analysis of the 6 upper secondary school disciplinary plans with the CS framework I present a summary table and use a radar graph to condense the results. Radar graphs are useful to present multivariate data in the form of a two-dimensional chart of three or more quantitative variables represented on axes starting from the same point (Seide et al., 2021). The radar graph in this article will sort the CS areas as axes to reveal how each disciplinary area performs in terms of the explicit strategies to develop CS.



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## **Analysis of Teachers' beliefs about their own ability to deliver 21st-century skills**

I study whether upper secondary school teachers believe are capable to deliver 21st-century skills at upper secondary school in Mexico. I understand beliefs as teachers' explicit response to have information, feel supported, prepared, able and motivated to teach 21st-century skills and to implement the NC.

**Data collection.** The BC carried out a set of training courses on CS with lower and upper secondary teachers between 2016 and 2018 in four states in Mexico: Ciudad de Mexico, Guanajuato, Jalisco and Sonora. I was invited to perform a qualitative evaluation of teachers' experiences during the trainings. I negotiated with the BC to collect information for personal research purposes, which is the data presented in this article.

At upper secondary school level, I carried out eight focus groups: two focus groups at each State (Ciudad de Mexico, Guanajuato, Jalisco and Sonora) with teachers who participated in the trainings between 2016 and 2018. A total of 72 teachers participated in the discussion groups. Teachers were selected at random to have an equal representation of male and female; as well as teachers coming from different school backgrounds. The focus group discussion guides included the following themes:

- Readiness: teachers' information and sense of support regarding the implementation of 21st-century skills and the upper secondary NC.
- Ability: teachers' experiences implementing the NC and 21st-century skills (accuracy in 21st century concepts and use of 21st-century skills strategies).
- Motivation: teachers' opinions on 21st-century skills and their applicability in the Mexican context.

The purpose of a focus group interview is to provide an in-depth exploration and is commonly used to give teachers the opportunity to reflect on their beliefs, experience and practice while enquiring about a topic (Kuh, 2016). I worked as a moderator in each group and the participants agreed for me to video record our conversations; also, they agreed for an extra researcher to work as an observer at each focus group. The researcher took additional notes during the discussions. Each focus group had a duration of between 120 to 165 minutes. A total of 1,286 minutes of discussion were recorded and analysed.

**Focus groups analysis.** My analytic technique for the eight focus groups involved the transcription of the discussions. I supplemented the transcripts with observational data obtained during the interviews. My additional data included my in-situ notes and my support team's observations of the interviews. I also watched the videotapes of each group discussion and took additional notes on the time spent on the issues as well as the intensity of participants' expressions.

To analyse the transcripts, I used the “scissor-and-sort technique” which includes going through the transcript and identifying those sections that are relevant to the research questions using the categories presented in Table 2. Based on the initial reading of the transcripts, I developed a classification system for major topics and issues; then I identified material in the transcripts related to each topic.

The analysis followed a categorization system, selecting representative statements regarding the topics from the transcripts. I then analysed the data to develop an interpretation of the meaning of teachers’ comments.

Finally, it is relevant to clarify that the qualitative data collection performed does not allow us to generalize teachers’ opinions.

**Table 2:** Categories and subcategories in the analysis of teachers’ beliefs about their own capability to implement 21st-century skills

Category	Subcategory	Questions included in the discussion guide
Readiness	<ul style="list-style-type: none"> <li>• Support</li> <li>• Applicability</li> </ul>	<ul style="list-style-type: none"> <li>• What kind of support did you get to teach 21st-century skills?</li> <li>• Do you feel ready to teach 21st-century skills?</li> </ul>
Ability	<ul style="list-style-type: none"> <li>• Accuracy in 21st-century skills concepts</li> <li>• Use of 21st-century skills strategies</li> </ul>	<ul style="list-style-type: none"> <li>• How are you implementing 21st-century skills in your classroom?</li> <li>• How capable/able you feel to put into practise 21st-century skills in your classroom?</li> <li>• Can you tell me one example of how you have put in practise 21st-century skills in your classroom?</li> </ul>
Motivation	<ul style="list-style-type: none"> <li>• Personal Motivation</li> <li>• Perception on students’ value to 21st-century skills</li> </ul>	<ul style="list-style-type: none"> <li>• Do you feel encouraged/motivated to implement the NC?</li> <li>• Do you feel encouraged/motivated to use 21st-century skills in the classroom?</li> <li>• Do you feel that 21st-century skills are relevant in the Mexican context?</li> <li>• How have your students welcomed the NC and/or the use of 21st-century skills in the classroom?</li> </ul>

**Note:** Own elaboration.

## Findings

In this section, I present the major findings concerning the elements of the NC as 21st-century skills framework at upper secondary school as well as upper secondary school teachers’ beliefs on their 21st-century skills implementation capability.

### The balance of the New Curriculum in 21st-century skills elements

The analysis studies whether the NC at upper secondary school (graduate profile and education plan by discipline) supports the implementation of 21st-century skills by providing balance. As mentioned before, I analysed the graduate profile and disciplinary plans with 6 matrixes. The first matrix is presented in Table 3. The matrix lists the upper secondary school graduate profile items to compare them with the six CS areas. The second matrix in Table 4

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shows a summary of the comparison between the upper secondary school education plan descriptions by discipline: Mathematics, Experimental Sciences, Communication, Social Sciences, and Humanities, with the six CS areas; while figure 1 is a radar graph that plots the results of the disciplinary plans in comparison with the development of each CS.

It is relevant to mention that this methodology provides an analysis with a weighted sum of values (Hernández Fernández & Rubio de los Santos, 2017), in other words the values presented show a weighted sum of strategies in place that correspond with the CS model descriptions.

**Table 3:** Analysis results of the match between the upper secondary school graduate profile and the Core

Graduate Profile Item	Critical Thinking and Problem Solving	Collaboration and Communication	Creativity and Imagination	Citizenship	Digital Literacy	Student Leadership
1. Love for Mexico	6	19	6	10	0	16
2. Respect for diversity	19	19	6	19	10	16
3. Cares for environment	19	6	19	19	0	10
4. Values art and culture	13	19	13	19	0	3
5. Collaborates	6	19	19	19	10	13
6. Communicates	6	19	19	0	10	13
7. Uses digital skills	6	0	19	0	19	10
8. Seeks to understand their surroundings	13	13	19	19	10	19
9. Thinks critically	19	19	19	19	10	16
10. Numerical concepts	19	0	19	0	19	6
11. Financial aspects	19	0	6	0	10	3
12. Regulates emotions	19	19	6	10	0	10
<b>Overall Weighted value</b>	<b>146</b>	<b>120</b>	<b>158</b>	<b>105</b>	<b>86</b>	<b>101</b>

**Note:** Own elaboration.

**Table 3** presents the matrix constructed in the analysis of the graduate profile match to 21st-century skills model. As it can be observed, the upper secondary graduate profile shows more correlation to the Creativity and Imagination CS. In second place is the Critical Thinking and Problem Solving, followed by Collaboration and Communication. It is not surprising that those three CS were the most aligned aspects of the graduate profile to the CS model. The rhetoric from the federal government and the Ministry of Education has been to switch from a system that made students memorize (Sánchez Aguilar, 2014) and had little or non-existent encouragement to think independently.

Conversely, **Table 3** shows in orange and red the least balanced aspects of the graduate profile to the CS model. We can observe that the least aligned aspect of the graduate profile is Digital Literacy followed by Student Leadership and Personal Development as well as Citizenship.

The difference in the match between each item of the graduate profile and the six areas of the CS model shows that the NC is not setting a balanced framework for the development of 21st-century skills. The NC is putting more emphasis on the development of few skills while neglecting others. A meaningful NC must manage to include relevant strategies for all skills; when the NC fails to do so from the graduate profile level it shows how difficult it will be to find balance in the discipline planning.

Furthermore, I revised the specific contents and expected learnings in the following disciplines: Mathematics, Experimental Sciences, Communication, Social Sciences, and Humanities included in the NC at upper secondary school level. **Table 4** includes a summary of the match between the upper secondary school NC by discipline and the CS model.

**Table 4:** Analysis results of the match between the upper secondary school graduate profile and the Core Skills model

Disciplinary Subjects	Critical Thinking and Problem Solving	Collaboration and Communication	Creativity and Imagination	Citizenship	Digital Literacy	Student Leadership and personal development
Mathematics	8	3	2	5	4	5
Experiential Sciences	14	5	6	8	3	11
Communication	9	12	5	12	5	12
Social Sciences	10	5	3	10	2	10
Humanities	11	11	5	16	1	16

**Note:** Own elaboration.

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I observe that Mathematics has the worst alignment with the 21st-century skills. The reason is that the strategies included in the planning mostly include components related to Critical Thinking and Problem Solving, neglecting the development of other relevant skills such as Creativity and Imagination, Communication and Digital Literacy. The lack of a complete set of strategies related to learning and innovation skills in the Mathematics discipline is regretful as the NC does not seem to have enough strategies to deal with the well-known problems that Mexican students have to solve mathematics problems and to innovate in their solutions (Sánchez Aguilar, 2014).

With respect to Experimental Sciences, the analysis suggests better relation between the NC and Critical Thinking and Problem Solving and Student Leadership and Personal Development. Experimental Sciences relate very much to the use of technology; however, it shows very little match with the Digital Literacy skills.

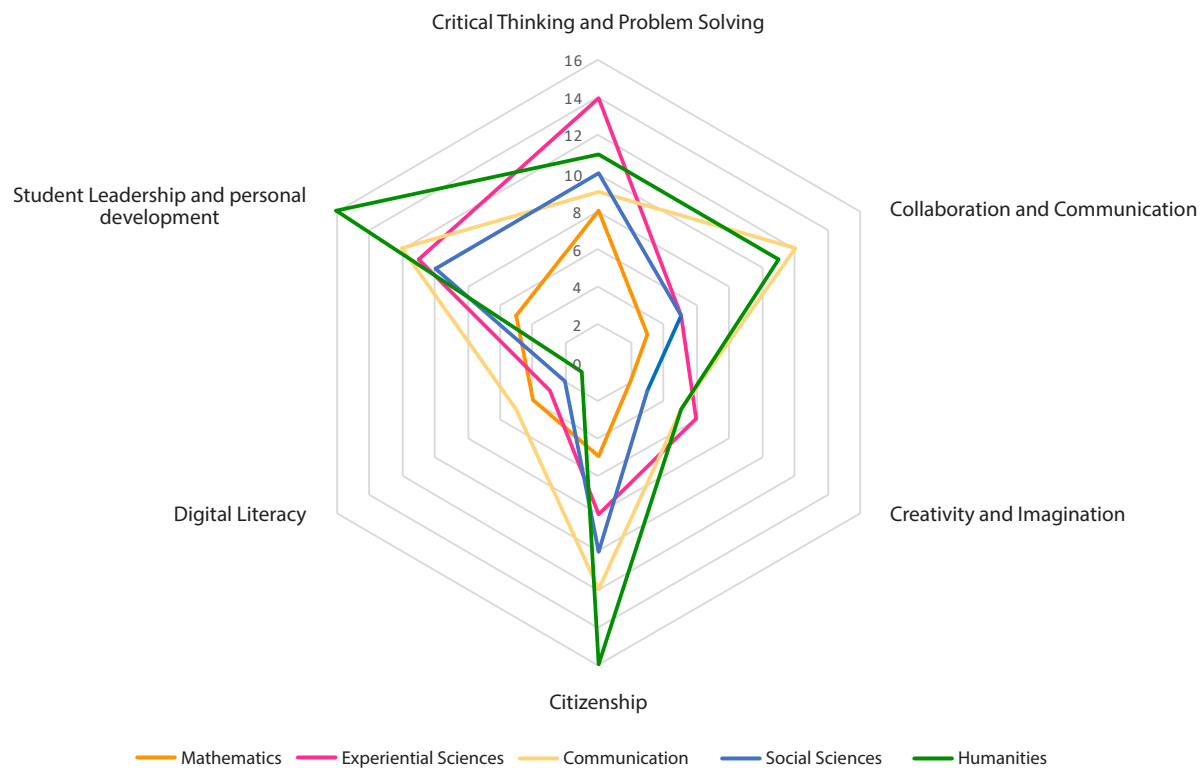
Furthermore, the Communication discipline shows good alignment with Collaboration and Communication, Citizenship and Student Leadership and Personal Development. The analysis shows that the discipline includes the relevant number of strategies to fulfil its objectives.

For Social Sciences, the NC shows alignment with Critical Thinking and Problem Solving, Citizenship and Student Leadership and Personal Development. The discipline has a good number of strategies in place to fulfil its objectives; however, it appears that more Communication and Collaboration strategies are needed in the teaching of the subject.

Humanities shows the greatest level of alignment as a whole with the CS model and the highest level of alignment is with Citizenship and Student Leadership and Personal Development, followed by Critical Thinking and Collaboration and Communication. That alignment can be considered a strength as the CS model suggests that Humanities and Social Sciences teaching will benefit from linking in a practical way those aspects that promote social awareness, inclusion and cohesion (British Council, 2016).

Observing the overall results, Figure 1 presents a summary to observe how balanced is each disciplinary plan in providing 21st-century skills strategies. This radar graph is elaborated placing the maximum number of strategies found as axis, in this case 16 strategies was the maximum. An aligned and balanced plan would show the maximum value at all CS areas forming a hexagon at value 16 axis. Additionally, when observing balance, we could look for hexagon shapes at all disciplines. That would be desirable as that would show that each disciplinary area places the same level of importance in the development of each 6 CS.

Overall, the disciplinary plans do not show balance in the development of CS as it can be observed in Figure 1. There is no disciplinary area that forms a hexagon shape which will suggest that a balanced number of strategies are in place to foster CS. What we can observe is that Critical Thinking and Problem-Solving skill and Citizenship are the CS that have more alignment, which is congruent with the results of the analysis at the graduate profile level.

**Figure 1:** Analysis results of upper secondary school disciplinary plans

**Note:** Own elaboration

Conversely, the Digital Literacy skill has the lowest level of alignment at disciplinary level, which corresponds with the results at graduate profile level. Despite the NEM highlighting the importance of the use of technologies, neither the graduate profile nor the NC has been successful in establishing this as a priority in the curricular strategies.

The results show that the NC for upper secondary school do not comply with providing a balanced set of skills that supports the implementation of 21st-century skills which could diminish its effectiveness to promote 21st-century skills learning. The analysis shows that further work is needed to achieve a balance in the required strategies and planning for an adequate framework for 21st-century skills development in the Mexican education system.



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## Upper Secondary School Teachers' beliefs about their own capability to implement 21st-century skills

The results presented here cover upper secondary school teachers' beliefs about their own capability to implement 21st-century skills and the NC. The results are presented by the three general themes used in the analysis: readiness, ability, and motivation.

With regards to readiness (perceived support and opinion on the applicability of 21st-century skills in Mexico), teachers mentioned that they agree Mexico needed a curriculum reform and that a focus on 21st-century skills was the most logical option for change. In spite of the vast majority of teachers admitting that they find 21st-century skills necessary and relevant, they conveyed that they do not think they could put those skills into practice because of the lack of actual support from the Ministry of Education. Some teachers highlighted that despite the Ministry of Education proved that the 21st-century skills are important, they do not get the impression that effort is being placed on the actual implementation. This view can be seen from some of the statements made by the teachers during the focus groups:

*They (Ministry staff) sent lots of posters to paste on the walls of our schools about what the NC is about, the pillars, the expected learnings and so on. As if, that would automatically make us understand what to do! No one came to explain.* Teacher in Jalisco

*I personally read the NEM and the NC and made some research on 21st-century skills. However, I do not think most of my colleagues (other teachers in my school) have. Some are just too busy; others maybe do not care as much. I do not think that we are ready to put the NC into practise.* Teacher in Guanajuato

Few teachers in the focus groups remained quiet when asked their opinion of 21st-century skills and the NC. It is likely that the teachers that did not want to participate have not formed an opinion on the matter because lack of information.

Moreover, a significant amount of the teachers mentioned that they had never received actual training on either the NC or 21st-century skills from the Ministry of Education and as a result, they do not feel ready to teach 21st-century skills. The teachers in all the focus groups suggested that a practical approach is what teachers (in Mexico) lack the most:

*We need manuals, tools and examples to do planning for 21st-century skills teaching.* Teacher in Sonora

These results are supported by the findings presented before where the NC does not provide an adequate framework for the development of 21st-century skills. The graduate profile and the disciplinary plans, which are the written documents that teachers have access to, does not provide them with the necessary framework to change the way they teach.

With respect to ability (accuracy in concepts and use of strategies), several teachers appear to face serious misunderstandings on which and what are 21st-century skills and how they can develop them in students. For example, there were misunderstandings about whether 21st-century skills are developed in a transversal way or on their own. As one (Physics) teacher in Ciudad de México stated:

*Either they (students) keep formulas in their brain or they rationalize what they are doing. It's so difficult with our students to achieve both.* Teacher in Mexico City

Moreover, few teachers displayed incorrect knowledge of both 21st-century skills concepts and the implementation of the NC. For example, one teacher from Jalisco mentioned:

*To think critically is a difficult concept: what is critical to think about? Who is going to decide it? The NC is not telling us what the critical topics are.* Teacher in Jalisco

As for the data collected, the information provided to schools did not appear enough or the required for the implementation of either 21st-century skills or the NC. Teachers did not recognise strategies or examples to put 21st-century skills into practise. As a result, they struggled to find particular examples on how they have put 21st-century skills in practise in their own classrooms. Few exceptions were the cases of a biology teacher in Ciudad de Mexico and a Physics teacher in Jalisco. Both teachers showed particular interest to teach 21st-century skills and looked online for examples to perform experiments in their classroom that required students to engage and think further to what is normally expected.

These results also support the findings of the comparison between the NC and the CS model. The NC is not explicit in how the strategies and plans can foster the development 21st-century skills, as result teachers have misunderstandings in whether they could be developing skills while teaching each disciplinary area of the NC.

Finally, with regards to motivation (personal motivation and the perception of students' value), teachers from all four States mentioned that they value highly 21st-century skills. The teachers, in general, expressed that they find 21st-century skills relevant and pertinent for their teaching and the development of students. A teacher in Sonora mentioned having searched for 21st-century skills training or materials online in the past (before the Educational Reform). Some mentioned to have done it, as they are aware of "the modern world changes and the new environments their students will face when they finish school". One teacher pointed out:

*Students should not be taught the same things we were, as the world has changed greatly.* Teacher in Guanajuato

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However, several teachers mentioned that their students have such low cultural capital that it is (in their words) almost impossible to work with them 21st-century skills. For example, one of the teachers in Jalisco said that students at upper secondary school still have serious difficulties to read and do simple addition problems that they cannot ask them to think critically. This view was also mirrored by another teacher in Sonora who mentioned that whilst teachers teach to the best of their ability, the students have so many other issues in their personal lives that it is difficult for them to focus on additional academic topics during class and they (the teachers) cannot be expected to do much more.

In every focus group, there were teachers who had doubts about teaching 21st-century skills when working with marginalized students. In their view, students who come from poor backgrounds will not be able to integrate learning of an academic subject and a skill at the same time.

This unexpected aspect that raised in the conversations with teachers suggests that the NC has failed to educate and show teachers how through 21st-century skills students can learn. It seemed that there is a preconception that 21st-century skills can only be taught when students have reached a certain level of knowledge in that sense it is an advanced knowledge that they can present to their students when they are ready.

## Discussion and final remarks

Evidence shows that education systems face the challenge of designing a way to translate paradigms and frameworks into plans that can make all involved actors participate and promote students' 21st-century skills meaningful learning. Mexico, with the 2012 Educational Reform, had the implicit, and common, assumption that government laws and plans will translate into school changes (Gil Antón, 2018). It is therefore presumed that the curriculum is correct and adequate and that teachers will know what to do to implement 21st-century skills. The changes are expected to happen in a sort of inertial movement whereby teachers will automatically implement the NC by reading about it (Gil Antón, 2018). Notwithstanding, evidence has shown that a great deal of work is needed to put 21st-century skills educational plans into action (van de Oudeweetering & Voogt, 2018).

This article shows how the Mexican education system remains with the challenge of having in place a balanced curriculum, teachers' professional development and suitable learning environment for 21st-century skills instruction (Marope et al., 2015; OECD, 2015). Particularly, the findings show that Mexico has in place an upper secondary school NC with 21st-century skills emphasis. However, the NC does not show balance in the objectives and strategies to provide equal weight for the development of each 21st-century skill. The literature has shown that the lack of liaison between the plans and the actual strategies for implementation within the

curriculum could place huge obstacles for 21st-century skills successful implementation (Barrot, 2019; van de Oudeweetering & Voogt, 2018). “Harmony” and “Balance” in the strategies are crucial to acquire meaningful 21st-century skills learning (Barrot, 2019; Mishra & Mehta, 2017).

The findings also show that teachers support the implementation of 21st-century skills at upper secondary school in Mexico. Moreover, teachers show awareness that students need to develop 21st-century skills in the modern world. However, the findings show that teachers observe four main obstacles in the implementation of 21st-century skills at upper secondary school in Mexico. The first challenge for teachers’ support is the **lack of involvement from the Ministry of Education and relevant stakeholders**. Most teachers highlighted that they observed that the Ministry of Education has not been actively involved in the implementation of the NC. As a result, teachers report lacking full information about the NC and the implementation plans. Secondly, and related to the previous challenge is the **lack of relevant training on 21st-century skills** and the NC. Teachers expressed that they need training to successfully change the way they teach and plan the classes. This aspect is relevant as previous research has highlighted how crucial it is for the implementation that teachers are competent to put new frameworks into action (Marope et al., 2015; OECD, 2015).

Thirdly, **teachers have misunderstandings and misconceptions on 21st-century skills concepts**. The fourth observed challenge is **teachers’ perceptions on students’ capabilities to learn**. Teachers mentioned doubts about the applicability of 21st-century skills framework to marginalized students. Both challenges could put implementation at risk as it will limit the amount of exposure those students would in fact have to the NC and 21st-century skills (Fernandez, 2013).

It is relevant to remember that my study does not value the quality of the NC itself and the qualitative data collection with teachers cannot be generalized. However, the triangulation of results is useful to draw two main conclusions and policy implications. First, the Ministry of Education has progressed in providing a 21st-century skill learning environment through a curriculum. Notwithstanding, the findings highlight that the Mexican curriculum at upper secondary level will benefit from an improvement. Concerning the latter, relevant literature has suggested that education systems should define what skills are needed (Cárdenas et al., 2019). To do so, it is recommended to consider the following steps: 1) Clearly define the objectives for the development 21st-century skills that will compile the graduate profile; 2) Align the strategies to those objectives in a balanced way to guarantee that every skill is given equal importance in the planning; 3) Guarantee that the organizational structure can respond to the challenges (teachers training is a mechanism); 4) Perform monitoring of the progress of the implementation to identify problems that arise during the transition period; and 5) Learn from the lessons derived from the implementation experience to perform adjustments or major redesign when needed (Cárdenas et al., 2019).



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Second, the findings provide useful evidence on teacher's opinions, which are relevant to consider for future improvements. It is important that teachers perceive that they are being accompanied through the process of implementing a 21st-century skills framework. Providing adequate training is fundamental in three senses: to provide theoretical and practical support, to motivate teachers to change the way they regularly plan and teach in their classrooms, and to recognize students' capabilities to learn (Donovan et al., 2014).

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### Supplementary material statement

The following supplementary material is available:

- Paper's preprint version at <https://doi.org/10.5281/zenodo.4891776>
- Data Management Plan and Data Set at <http://doi.org/10.15359/ree.26-1.22>

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