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## Contents

### Articles

- 1 Comparative Study on Results of Euler, Improved Euler and Runge-Kutta Methods for Solving the Engineering Unknown Problems**  
Khaing Khaing Lwin
- 7 Contributions of Organizational Culture to University Internationalization**  
Doreen Ahwireng Yegan Pillay
- 19 Conceptual, Operational and Policy Issues in Servicing Gifted Students in Mexico**  
Pedro Sanchez Escobedo

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ARTICLE

# Comparative Study on Results of Euler, Improved Euler and Runge-Kutta Methods for Solving the Engineering Unknown Problems

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ABSTRACT

The paper presents the comparative study on numerical methods of Euler method, Improved Euler method and fourth-order Runge-Kutta method for solving the engineering problems and applications. The three proposed methods are quite efficient and practically well suited for solving the unknown engineering problems. This paper aims to enhance the teaching and learning quality of teachers and students for various levels. At each point of the interval, the value of  $y$  is calculated and compared with its exact value at that point. The next interesting point is the observation of error from those methods. Error in the value of  $y$  is the difference between calculated and exact value. A mathematical equation which relates various functions with its derivatives is known as a differential equation. It is a popular field of mathematics because of its application to real-world problems. To calculate the exact values, the approximate values and the errors, the numerical tool such as MATLAB is appropriate for observing the results. This paper mainly concentrates on identifying the method which provides more accurate results. Then the analytical results and calculates their corresponding error were compared in details. The minimum error directly reflected to realize the best method from different numerical methods. According to the analyses from those three approaches, we observed that only the error is nominal for the fourth-order Runge-Kutta method.

## 1. Introduction

The unknown engineering problems came from various points of view. The numerical methods play a vital role in solving the problems with a better experience in science and engineering areas. Differential equations solve engineering mathematical problems in more or less every section of science, technology, engineering, and mathematics (STEM). In engineering mathematics section, several real problems get up in the form of differential

equations. These equations are either in the form of an ordinary differential equation or partial differential equation for defining the unknown problems. Customarily, most of the unknown engineering problems modelled by these differential equations are accordingly complicated that it is inflexible to determine the exact solution. One of the three approaches is occupied to imprecise the solution. In the methods of Euler, Improved Euler and Runge-Kutta, the interval length  $h$  should be kept back small, and these methods can be applied for tabularizing  $y$  over bounded

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range only. The original conditions are quantified at the initial point only are entitled initial value problem<sup>[5,6]</sup>.

The analytical approaches can be applied to elucidate only a designated class of differential equations that manage physical coordination do not retain, on the whole, closed-form solutions<sup>[3]</sup>. The numerical methods change to the approximate results. In this paper, the three standard numerical methods such as Euler, Improved Euler, and Runge-Kutta to elucidate initial value problems of differential equations are presented<sup>[1,8]</sup>. In contrast, the Runge-Kutta method's results congregate closer to analytical solutions, and its requirements less iteration to contribute precise solutions. Consequently, the Runge-Kutta method provides better results for solving unknown engineering problems.

The paper is well-organized with the following sections. Section II presents the background knowledge on three techniques. Section III mentions analysis and discussion. Section IV gives the comparison results and errors. Finally, section V offers the conclusion of the study.

## 2. Background Knowledge on Three Numerical Methods

### A. Euler Method

The Euler method is the unpretentious one-step method to solve the unknown engineering problem<sup>[7]</sup>. It is an uncomplicated unequivocal technique for numerical ordinary differential equations. It is the primary numerical method for solving initial value problems and exemplifies the perceptions convoluted in the advanced methods<sup>[1]</sup>. It is indispensable to study for the reason that the error analysis is easier to apprehend. The all-purpose formula for Euler approximation<sup>[5-6]</sup> is

$$y_{n+1} = y_n + hf(x_n, y_n), \quad n = 0, 1, 2, \dots \quad (1)$$

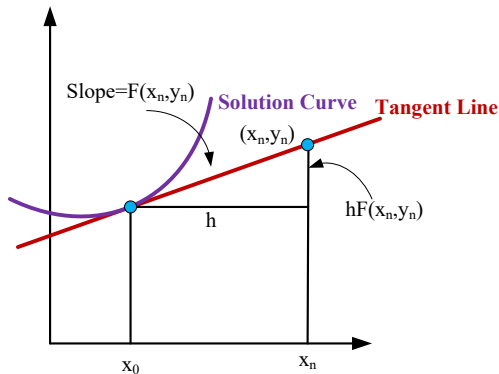


Figure 1. Illustration of the Euler Method

### B. Improved Euler Method

The improved Euler technique stretches a superior enlargement in accurateness over the original Euler method. This technique is entitled after Karl Heun<sup>[1]</sup>. In this technique, two derivatives are utilized to achieve an improved estimation of the slope for the all-inclusive interval by averaging them. This technique is established on two values of the dependent variables the predicted values  $y_{n+1}^*$  and the final value  $y_{n+1}$ <sup>[5-6]</sup> which are given by

$$y_{n+1}^* = y_n + hf(x_n, y_n) \quad (2)$$

The broad-spectrum formulation for Improved Euler approximation is

$$y_{n+1} = y_n + \frac{h}{2} [f(x_n, y_n) + f(x_{n+1}, y_{n+1}^*)], \quad n = 0, 1, 2, \dots \quad (3)$$

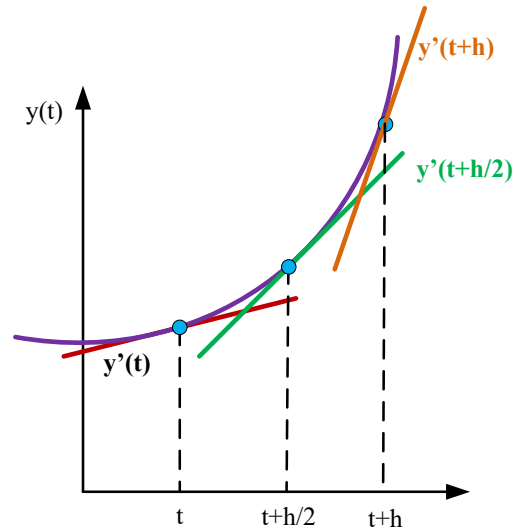


Figure 2. Illustration of the Improved Euler Method

### C. Runge-Kutta Method

Two German mathematicians concocted this technique. The Runge-Kutta technique is the greatest widespread technique because it is somewhat precise, stable and tranquil to create the mathematical program for numerical analyses. This technique can elucidate Taylor's series solution without difficulty. It does not ultimatum the aforementioned computational of higher  $y(x)$  derivatives in Taylor's series technique<sup>[4]</sup>. The fourth-order Runge-Kutta method is extensively utilized for unravelling initial value problems for the ordinary differential equation. The broad-spectrum formulation for Runge-Kutta approximation<sup>[5-6]</sup> is

$$y_{n+1} = y_n + \frac{1}{6} [k_1 + 2k_2 + 2k_3 + k_4], \quad n = 0, 1, 2, \dots \quad (4)$$

$$k_1 = hf(x_n, y_n) \tag{5}$$

$$k_2 = hf\left(x_n + \frac{h}{2}, y_n + \frac{k_1}{2}\right) \tag{6}$$

$$k_3 = hf\left(x_n + \frac{h}{2}, y_n + \frac{k_2}{2}\right) \tag{7}$$

$$k_4 = hf(x_n + h, y_n + k_3) \tag{8}$$

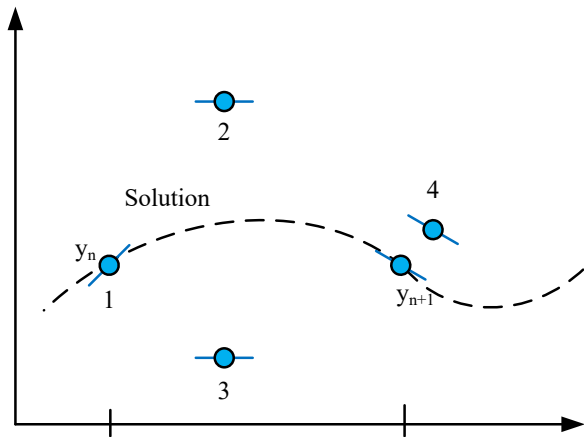


Figure 3. Fourth Order Runge-Kutta Method

#### D. Errors Calculation

The calculation of Error-values is essential to check the performance of the applied technique. The measurement of errors could be calculated as follows:

$$\text{Actual Error} = E_{TRUE} - E_{CALC} \tag{9}$$

$$\text{Absolute Error} = |E_{TRUE} - E_{CALC}| \tag{10}$$

$$\text{Relative Error} = \frac{|E_{TRUE} - E_{CALC}|}{|E_{TRUE}|} \tag{11}$$

$$\text{Percentage Error} = \frac{|E_{TRUE} - E_{CALC}|}{|E_{TRUE}|} \times 100\% \tag{12}$$

### 3. Analysis and Discussions

This section mentions the analyses and discussions on the three types of numerical methods. In this study, there are three case studies for checking the performance of the numerical techniques.

#### 3.1 Case Study (1)

In this case, we focused on the first case of  $y' - y = e^{2x}$  numerical methods to find the performance results with the help of MATLAB<sup>[2,9,10]</sup> language. The proposed engineering problem in this case study 1 is signif-

icant to solve the control system design and engineering scenario. For this analysis, some parameters are assumed for performance checking  $y(0) = 1$  and  $h = 0.1$ ; our initial condition and specific constant parameter with 10 steps.

After implementing the numerical calculation with MATLAB<sup>[2,9,10]</sup>, the exact values can be observed as the array style with Exact = [1.0000 1.2214 1.4918 1.8221 2.2255 2.7183 3.3201 4.0552 4.9530 6.0496 7.3891] and the values of Euler = [0 1.0000 0.6000 3.0471 0.1000 1.2000 0.7000 3.6838 0.2000 1.4421 0.8000 4.4577 0.3000 1.7355 0.9000 5.3988 0.4000 2.0913 1.0000 6.5437 0.5000 2.5230]. If we choose the value of exact is 7.3891 and the value of approximate is 6.5437, the actual error value may be obtained as 0.8454.

If we choose the mode of Improved Euler techniques, the actual error value may be obtained as 0.0134. If we opt for the technique of Runge-Kutta, the actual error value could be observed as 0.0001.

#### 3.2 Case Study (2)

In this case, we focused on the first case of  $y' + 2y = 4\cos 2x$  numerical methods to find the performance results with the help of MATLAB<sup>[2,9,10]</sup> language. The proposed engineering problem in this case study 2 is significant to solve the dynamical system design and engineering picture. For this analysis, some parameters are assumed for performance checking  $y(0) = 2$  and  $h = 0.1$ ; our initial condition and specific constant parameter with 10 steps.

After implementing the numerical calculation with MATLAB<sup>[2,9,10]</sup>, the exact values can be observed as the array style with Exact = [2.0000 1.9975 1.9808 1.9388 1.8634 1.7497 1.5956 1.4020 1.1723 0.9119 0.6285] and the values of Euler = [0 2.0000 0.6000 1.6549 0.1000 2.0000 0.7000 1.4689 0.2000 1.9920 0.8000 1.2431 0.3000 1.9620 0.9000 0.9828 0.4000 1.8998 1.0000 0.6954 0.5000 1.7985]. If we choose the value of exact is 0.6285 and the value of approximate is 0.6954, the actual error value may be obtained as -0.0669.

If we choose the mode of Improved Euler techniques, the actual error value may be obtained as 0.0062. If we opt for the technique of Runge-Kutta, the actual error value could be observed as 0.

#### 3.3 Case Study (3)

In this case, we focused on the first case of  $y' = (y-x)^2$

numerical methods to find the performance results with the help of MATLAB<sup>[2,9,10]</sup> language. The proposed engineering problem in this case study 3 is significant to solve the vibrational system design and engineering depiction. For this analysis, some parameters are assumed for performance checking  $y(0) = 0$  and  $h = 0.1$ : our initial condition and specific constant parameter with 10 steps.

After implementing the numerical calculation with MATLAB<sup>[2,9,10]</sup>, the exact values can be observed as the array style with Exact = [0 0.0003 0.0026 0.0087 0.0201 0.0379 0.0630 0.0956 0.1360 0.1837 0.2384] and the values of Euler = [0 0 0.6000 0.0508 0.1000 0 0.7000 0.0810 0.2000 0.0010 0.8000 0.1193 0.3000 0.0050 0.9000 0.1656 0.4000 0.0137 1.0000 0.2196 0.5000 0.0286]. If we choose the value of exact is 0.2384 and the value of approximate is 0.2196, the actual error value may be obtained as 0.0188.

If we choose the mode of Improved Euler techniques, the actual error value may be obtained as -0.0013. If we opt for the technique of Runge-Kutta, the actual error value could be observed as 0.

#### 4. Comparison of Results And Errors

In this section, the author compares numerical results with the exact solution to determine corresponding errors and check out which methods provide better results.

##### E. Comparison Results and Errors of Case Study (1)

Table 1. Comparison Results of Case Study (1)

n	$x_n$	Exact value	Euler method	Improved Euler method	Runge-Kutta method
0	0	1.0000	1.0000	1.0000	1.0000
1	0.1	1.2214	1.2000	1.2211	1.2214
2	0.2	1.4918	1.4421	1.4911	1.4918
3	0.3	1.8221	1.7355	1.8208	1.8221
4	0.4	2.2255	2.0913	2.2234	2.2255
5	0.5	2.7183	2.5230	2.7152	2.7183
6	0.6	3.3201	3.0471	3.3158	3.3201
7	0.7	4.0552	3.6838	4.0494	4.0552
8	0.8	4.9530	4.4577	4.9452	4.9530
9	0.9	6.0496	5.3988	6.0394	6.0496
10	1	7.3891	6.5437	7.3757	7.3890

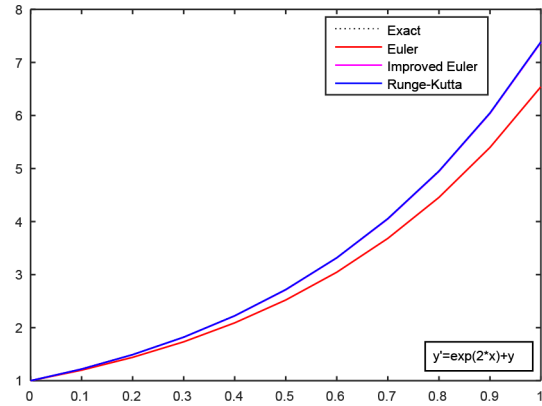


Figure 4. Performance Comparison Results for Case Study (1)

Table 2. Comparison Errors of Case Study (1)

Euler method	Improved Euler method	Runge-Kutta Method
0.8454	0.0134	0.0001



Figure 5. Comparison Errors of Case Study (1)

##### F. Comparison Results and Errors of Case Study (2)

Table 3. comparison results of Case Study(2)

n	$x_n$	Exact value	Euler method	Improved Euler method	Runge-Kutta method
0	0	2.0000	2.0000	2.0000	2.0000
1	0.1	1.9975	2.0000	1.9960	1.9975
2	0.2	1.9808	1.9920	1.9778	1.9808
3	0.3	1.9388	1.9620	1.9342	1.9388
4	0.4	1.8634	1.8998	1.8574	1.8634
5	0.5	1.7497	1.7985	1.7426	1.7496
6	0.6	1.5956	1.6549	1.5879	1.5956
7	0.7	1.4020	1.4689	1.3940	1.4020
8	0.8	1.1723	1.2431	1.1645	1.1723
9	0.9	0.9119	0.9828	0.9047	0.9119
10	1	0.6285	0.6954	0.6223	0.6285



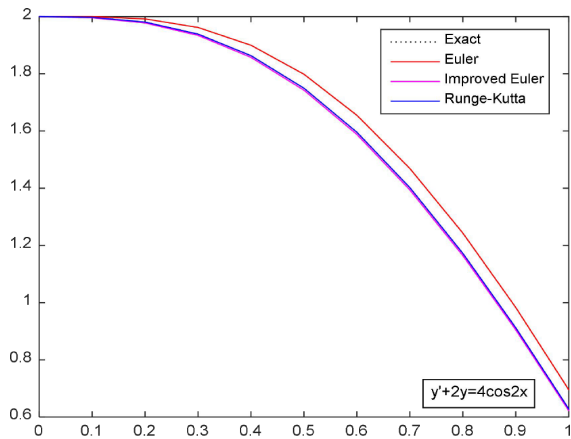


Figure 6. Comparison Errors of Case Study (2)

Table 4. Comparison Errors of Case Study (2)

Euler method	Improved Euler method	Runge-Kutt Method
-0.0669	0.0062	0.0000

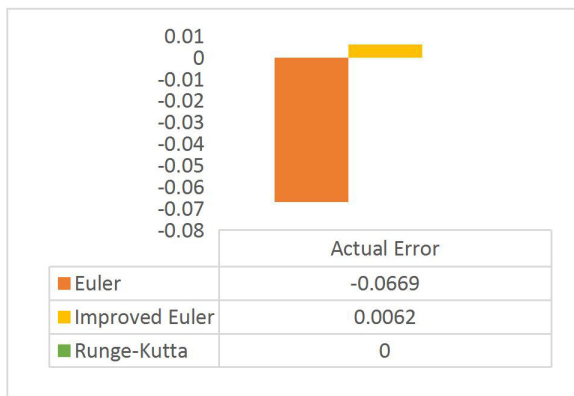


Figure 7. Comparison Errors of Case Study (2)

G. Comparison Results and Errors of Case Study (3)

Table 5. Comparison Results of Case Study (3)

n	$x_n$	Exact value	Euler method	Improved Euler method	Runge-Kutta method
0	0	0.0000	0.0000	0.0000	0.0000
1	0.1	0.0003	0.0000	0.0005	0.0003
2	0.2	0.0026	0.0010	0.0030	0.0026
3	0.3	0.0087	0.0050	0.0092	0.0087
4	0.4	0.0201	0.0137	0.0207	0.0201
5	0.5	0.0379	0.0286	0.0387	0.0379
6	0.6	0.0630	0.0508	0.0640	0.0630
7	0.7	0.0956	0.0810	0.0968	0.0956
8	0.8	0.1360	0.1193	0.1372	0.1360
9	0.9	0.1837	0.1656	0.1850	0.1837
10	1	0.2384	0.2196	0.2397	0.2384

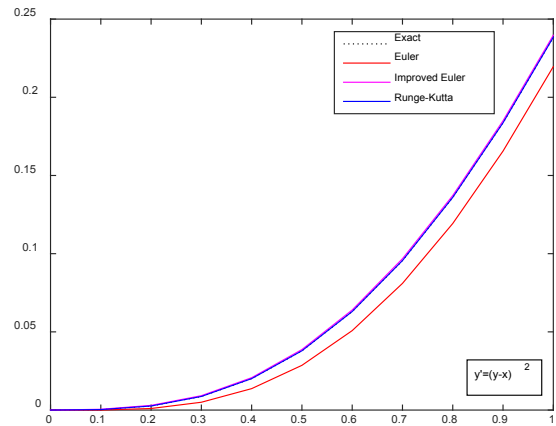


Figure 8. Comparison Errors of Case Study (3)

Table 6. Comparison Errors of Case Study (3)

Euler method	Improved Euler method	Runge-Kutta Method
0.0188	-0.0013	0.0000

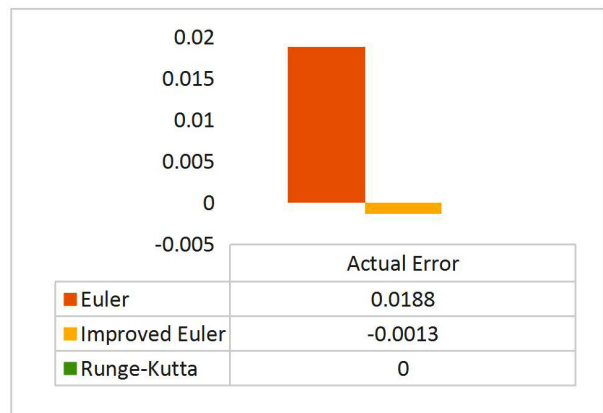


Figure 9. Comparison Errors of Case Study (3)

Upon spread over the Runge-Kutta technique, there is no evidence of any error values. This is because only four significant digits are well-thought-out. If more than four significant digits are utilized in that analyses, there may be the error values.

From the directly above tables and figures, we could observe that the values from the Runge-Kutta technique's result are very close to the exact value. This technique could provide high-level precise results than the Euler technique and the Improved Euler technique. Above three case studies, we could perceive that the Runge-Kutta technique stretches the minimum error values. Therefore, the Runge-Kutta technique is superior to the other two approaches.

5. Conclusions

In this paper, the Euler technique, Improved Euler

technique, and the Runge-Kutta technique solve ordinary differential equations in initial value problems for different kinds of engineering unknown problems. Finding more precise results needs Runge-Kutta for all approaches. The numerical solutions achieved by the three proposed approaches are a good covenant with the exact solution. Compared with the three methods under investigation, the convergence rate of Euler, Improved Euler and Runge-Kutta approaches could also be observed. The Euler technique and the Improved Euler technique were less precise values due to the imprecise numerical results acquired from the approximate solution compared to the exact solution. By and large, the Runge-Kutta technique is more precise than the other two techniques. The technique can help to study differential equations that have wide applications in daily life such as control system, dynamical system, and vibrational system design and engineering. The technique converges faster to the exact solution than the Euler technique, Improved Euler technique. It might be established that the Runge-Kutta technique is efficient and effective with good accuracy for solving the unknown engineering problems.

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ARTICLE

# Contributions of Organizational Culture to University Internationalization

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ABSTRACT

Responding to an increasingly globalized world, universities are training students to function in a multicultural environment through internationalization. Institutional culture can influence policies and practices for internationalization. Research in internationalization indicate that majority of the studies on the contributions of organizational cultures to internationalization across universities focused on the perspectives of faculty and university senior level administrative personnel and neglected the views of students. This qualitative case study explored students' understanding of how organizational culture contributes to promote internationalization using international events that occur at two U.S universities. Semi-structured interviews were used for data collection. Purposeful and snowball sampling were employed to select domestic and international undergraduate and graduate students for the study. Findings indicate that integration into university family, community relationship, buffering, communication, symbols, and shared values and beliefs cultures are critical to promote higher education internationalization.

## 1. Introduction

The rapid growth of globalization and internationalization among nations suggests that institutions of higher education modify educational practices to incorporate international dimensions into teaching, research, and service functions through internationalization (Knight, 2008).<sup>[27]</sup> Qiang (2003)<sup>[41]</sup> posits that globalization requires that institutions of higher education provide students with increased international knowledge and intercultural skills needed to succeed in a world which is increasingly becoming interconnected. Deardorff (2006)<sup>[17]</sup> argued that students today need to develop skills to interact in inter-

cultural settings effectively and appropriately, “increase their cultural awareness and demonstrate an understanding of the worldviews of others” (p. 247). Institutions of higher education ability to train students to develop such intercultural knowledge and competency is the result of internationalization (Deardorff, 2006).<sup>[17]</sup> Knight (2003)<sup>[29]</sup> maintains that internationalization is a process of integrating international, intercultural, or global dimensions into the purpose, functions or delivery of post-secondary education” (p. 6). As part of internationalization process, some institutions have developed a campus culture and climate that values and supports intercultural perspectives and initiatives (Qiang, 2003).<sup>[41]</sup> Institutions' culture is

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critical to how institutions respond to external and internal influences to internationalize (Green, 2012).<sup>[20]</sup> Tierney (1988)<sup>[50]</sup> suggests that an organization's culture reflect what is done, how it is done, and who is involved in doing it. An organization's culture is concerned with decisions, actions, and communication both on an instrumental and symbolic level" (p. 3). Therefore, decisions, actions, and communication on instrumental and symbolic levels have the potential to foster or impede the processes of internationalization throughout an institution. Consequently, Knight (1994)<sup>[30]</sup> maintains that how far an institution moves in the process of internationalization depends on the institutional culture. Therefore, "developing a culture in the university that values and supports internationalization initiative is key to successful internationalization" (Knight, 1994, p. 4).<sup>[30]</sup> For institutions to offer international and intercultural knowledge training to students, there must be a driving force that can help carry out internationalization initiatives (Green, 2012).<sup>[20]</sup> One of such driving forces is the institutions' culture (Braskamp, Trautvetter, & Ward, 2006).<sup>[9]</sup> Consequently, there is the need for a culture that creates enabling conditions on campus for students to learn and interact with people from diverse cultural background (Alanko, Dalton & Sullivan, 2009;<sup>[15]</sup> Chickering & Braskamp, 2009).<sup>[13]</sup> Experiences of students in relation to their engagement with university strategies, the nature of their learning experience, and their perceived value of intercultural or international immersion experiences could contribute to perspectives on culture and internationalization (Agnew, 2012),<sup>[1]</sup> however, the perspectives of students have been ignored in studies relating to university culture and internationalization (Nussbaumer, 2013).<sup>[39]</sup> Given the need to create a culture that foster internationalization on campus to enhance students' international and intercultural knowledge, awareness, this study seeks to explore students' understanding of how institutions' culture contributes to promote internationalization. Whilst there are some studies on organizational culture and internationalization (Agnew & VanBalkom, 2009;<sup>[2]</sup> Agnew, 2012;<sup>[1]</sup> Bartell, 2003;<sup>[5]</sup> Green, 2012;<sup>[20]</sup> Nussbaumer, 2013;<sup>[39]</sup> Xuan, 2018),<sup>[53]</sup> these studies did not explore students' view on internationalization, specifically students' understanding of how institutions' culture contributes to promote internationalization. Thus, there is currently no study that explored students' understanding of how institutions' culture contributes to promote internationalization in the U.S. context. Hence, this study seeks to answer the following research question: what are students' understanding of how organizational culture contributes to promote higher education internationalization? Findings from this study will help senior management at

institutions of higher education to consolidate actions and decisions that foster internationalization to enrich students' international knowledge and awareness.

## 2. Literature Review

Bartell (2003)<sup>[5]</sup> views university culture as values and beliefs held by individuals such as: administrators, faculty, students, board members, and support staff working at the institution. These values and beliefs develop overtime and are transmitted orally, in writings, or through symbols (Bartell, 2003;<sup>[5]</sup> Becher & Towler, 2001;<sup>[6]</sup> Schein, 2010).<sup>[44]</sup> Researchers agree that institutions' staff have certain values that inform their decisions about how to carry out their duties (Agnew, 2012,<sup>[1]</sup> Silver, 2003).<sup>[46]</sup> These values and beliefs are very powerful and can positively or negatively impact institutions' internationalization processes (Bartell, 2003).<sup>[5]</sup> Thus, Qiang (2003)<sup>[41]</sup> observed that some institutions have created a campus culture that appreciates international dimensions and initiatives. Green (2012)<sup>[20]</sup> opines that institutions' culture help shape their response to external and internal influences to internationalize. According to Tierney (1988)<sup>[50]</sup> institution's culture is seen in decisions taken, how the decisions are implemented, as well as the people involved in implementation. Therefore, several researchers concur that university culture can promote or impede internationalization (Agnew & VanBalkom, 2009;<sup>[2]</sup> Agnew, 2012,<sup>[1]</sup> Bartell, 2003;<sup>[5]</sup> Green, 2012;<sup>[20]</sup> Nussbaumer, 2013).<sup>[39]</sup> Bartell (2003)<sup>[5]</sup> posits that for university internationalization to thrive, universities need "strong and outward oriented culture" (p. 65). Agnew and VanBalkom (2009)<sup>[2]</sup> examined the cultural readiness for internationalization at the micro, meso, and macro levels at two U.S. institutions using the Cultural Readiness for Internationalization (CRI) from the perspective of 54 university staff made up of chancellors, vice chancellors, provosts, deans, and executive directors of centers for internationalization. The authors reported that weak and internally oriented culture evident from "a lack of financial disposition for students to fund international experiences outside the U.S. and mismatch between cultural values, structural arrangement, and strategic plans" (p. 459) impeded internationalization, whereas strong and externally oriented culture promoted internationalization. Also, Burnett and Huisman (2009)<sup>[10]</sup> assessed how organizational culture influenced four Canadian universities' response to internationalization and found that collegial and enterprising cultures promoted internationalization. Similarly, Agnew (2012)<sup>[1]</sup> explored "how the interplay between university culture and ideologies support or impede internationalization" (p. 477) using Stier's (2004)<sup>[48]</sup> ideology framework—idealism,

instrumentalism, and educationalism” (pp. 3-5). Agnew (2012)<sup>[1]</sup> reported that strategic planning cultural practice is pivotal to institutions’ readiness for internationalization. Xuan (2018)<sup>[53]</sup> adopted Davies’ (2001)<sup>[16]</sup> model of means and styles of development of entrepreneurial cultures to explore the influence of institutional culture on internationalization at MUIC using international events that happen at MUIC. Xuan (2018)<sup>[53]</sup> found that international events that occur at MUIC are teaching and learning in English, foreign exchange program, engagement in MOUs with educational institutions within and outside Thailand, international accreditations, presence of foreign faculty, value for international academic ranking, maintains administrative and curricular policies consistent with international standards, provides financial support for faculty to participate in international conferences and research, and recruitment of international students. However, the study revealed that whilst all classes are taught in English, some of the after-school student activities are still communicated in Thai which discouraged smooth interaction between international students and domestic students. Moreover, the study revealed that some operations and implementations are not systematic-driven but rather ad hoc-driven. Consequently Xuan (2018)<sup>[53]</sup> concluded that MUIC is dominated by a pre-entrepreneurial culture, considering that MUIC internationalization processes fall within quadrant C in Davies’ (2001)<sup>[16]</sup> means and style of development of entrepreneurial culture. Indeed, whilst there is substantial studies on institutional culture and internationalization, much of the studies have focused on the views and perspectives of institutions’ senior level administrators in Canada, U.S, and Southeast Asia (Agnew, 2012,<sup>[1]</sup> Agnew & VanBalkom, 2009;<sup>[2]</sup> Bartell, 2003,<sup>[5]</sup> Nussbaumer, 2013,<sup>[39]</sup> Xuan, 2018),<sup>[53]</sup> however, no studies have explored students understanding of how organizational culture contributes to internationalization using international events that take place on campuses of higher education. Therefore, this study seeks to fill the gap in literature by exploring students’ understanding of how organizational culture contributes to internationalization using international events that occur at two U.S institutions of higher education.

### 3. Theoretical Framework

Schein’s (2010)<sup>[44]</sup> organizational culture and leadership framework was adopted to explore students’ understanding of how organizational culture contributes to promote internationalization using international events that occur at two U.S institutions of higher education. According to Schein (2010)<sup>[44]</sup> culture is “a set of basic tacit assumptions about how the world is, and ought to be, that

a group of people share and that determines their perceptions, thoughts, feelings and to some degree their overt behavior” (p. 11). Schein (2010)<sup>[44]</sup> posits that to understand the culture of a group of people or an organization, it is important to distinguish three fundamental levels at which culture manifests itself: “(a) observable artifacts, (b) espoused beliefs and values, and (c) basic underlying assumptions” (p. 24).

Schein (2010)<sup>[44]</sup> argued that artifacts are made up of concrete and tangible components within an organization. To understand the culture of an organization, the observable and concrete elements of an organization such as—“physical and social environment, technological output, written and spoken language, artistic production, overt behaviors, and rites” (Schein, 2010, p. 24)<sup>[44]</sup> need to be explored. However, Schein (2010)<sup>[44]</sup> argues that, solely focusing on artifacts of the organization to interpret the culture might be inadequate. Consequently, Schein (2010)<sup>[44]</sup> posits that researchers should use open-ended interviews and documents to understand the meanings organizations attach to artifacts. The second level of organizational culture is espoused values and beliefs (Schein, 2010).<sup>[44]</sup> Espoused values are the strategies, goals, and philosophies that organizations hold in high esteem. Schein (2010)<sup>[44]</sup> suggests that to understand the espoused beliefs and values of organizations, researchers must: distinguish between assumptions that guide performance, philosophy of the organization, and aspirations for future. Espoused beliefs and values often leave large areas of behavior unexplained, taking for granted that members of an organization understand the culture within an organization.

However, organizations’ espoused values and beliefs appear to be theoretical, and they can contradict practice, posing a challenge for outsiders to understand the culture of an organization (Schein, 2010).<sup>[44]</sup> Consequently, for outsiders to understand, interpret patterns, and predict future behavior of organizations, Schein (2010)<sup>[44]</sup> posits that researchers should explore deeper levels of culture which are the actions taken by a group of people to produce a desired outcome (Schein, 2010).<sup>[44]</sup> Repeated actions carried out and taken for granted by members of an organization become the “basic underlying assumptions” (Schein, 2010, p. 24).<sup>[44]</sup> According to Schein (2010)<sup>[44]</sup> seven basic assumptions underpin organizational culture:

- (1) the organization’s relationship with the environment;
- (2) the nature of human activity;
- (3) the nature of reality and truth—how is truth defined in the organization and how truth is physically and socially determined;
- (4) The nature of time—what is the organization’s basic orientation in terms of the past, present, and the future and

what kinds of time units are most relevant for work? (5) Human nature; (6) The nature of human relationship—what is the correct way for people to relate to each other? (7) Homogeneity versus diversity (p. 86). In summary, Schein (2010)<sup>[44]</sup> categorized organizational culture into three different levels namely: artifacts, espoused values, and beliefs as well as shared basic underlying assumptions. Schein (2010)<sup>[44]</sup> maintains that first, artifacts are the visible elements of an organization. Second, espoused values are the organization's declared set of values and norms that make the organization unique from other organizations. Third, shared basic assumptions are the bedrock of the organizational culture.

### 3.1 Methodology

The following methodology was followed to answer the research question: what are students' understanding of how organizational culture contributes to promote internationalization of institutions of higher education? Qualitative case study design was adopted to explore students' understanding of how organizational culture contributes to promote internationalization at two U.S. universities. Qualitative methodology is holistic and context sensitive (Patton, 2002),<sup>[40]</sup> allowing in-depth study and comparison within and across three specific areas (Glesne, 2011;<sup>[19]</sup> Patton, 2002,<sup>[40]</sup> Yin, 2014).<sup>[54]</sup>

### 3.2 Site of Study

The study was conducted at two U.S. institutions. Both institutions shared certain similarities namely: mid-sized, accredited public research institutions, enrolled international and domestic students, and faculty, and had international students and faculty offices. However, there were differences. The overall student population at MWU was 38, 857, with international students' population of 1, 859, whilst, ECU had a total student population of 29,114, with international student population of 1300.

ECU won the Senator Paul Simon and Andrew Heiskell awards for comprehensive campus internationalization and innovation (Childress, 2010).<sup>[12]</sup> ECU is a predominantly black campus, whereas MWU is mainly a white university.

### 3.3 Sampling and Sampling Technique

Purposeful and snowball sampling strategies were employed to identify eight students from each of the institutions. Students were sampled based on the following criteria— (1) domestic junior and senior undergraduates and graduate students, and international junior and senior undergraduate and graduate students. To identify inter-

national students at MWU for the study, the researchers attended international students' events. We introduced ourselves, explained the purpose and nature of the research and asked students for voluntary participation. Students who were interested exchanged their email addresses with us. The first author contacted interested students to find a convenient time, day, and venue for interview. Also, the first author requested a mailing list of domestic students from the registrar's office. Upon receiving the mailing list, an Excel spread sheet was used to sort through the email addresses based on the sampling criteria. Emails were sent to recruit participants. Purposeful sampling and snowball sampling strategies were adopted to recruit domestic and international students at ECU. The first author was granted permission to go to the Global Village and talk to students about the research and seek for voluntary participation. After purposefully identifying one student who agreed to participate in the study, the first author asked the students who first volunteered to participate in the study to help identify other students who might be interested in the study (Creswell, 2014;<sup>[14]</sup> Johnson & Christensen, 2008).<sup>[25]</sup>

### 3.4 Data Collection

The researchers received ethics approval from the Institutional Review Boards of both institutions before commencing data collection. Students' consent was sought for the interviews to be recorded with an audio recorder. Participants were assured that their confidentiality will not be compromised because, pseudonyms will be assigned to each of them. Also, the information provided will be used for academic purposes only. Consequently, data were collected via face-to-face semi-structured interviews, guided with an interview protocol which elicited data ranging from demographics, educational background, and international events and decisions that took place at both research sites. In addition, documents on internationalization events such study abroad flyers, *Year of* flyers, International Students events, and institutional website searches were explored to gather data.

### 3.5 Credibility Measures

Interviews, documents, and website searches were triangulated to ensure credibility as well as provide objectivity to the study. In addition, copies of transcripts were emailed to respondents for member checking (Creswell, 2014).<sup>[14]</sup> The purpose for adopting member checking was to allow respondents to clarify some of the views shared during the interview and ask follow-up questions for more insight into students' understanding of how institutional culture contributed to internationalization (Creswell,

2014,<sup>[14]</sup> Merriam, 2009;<sup>[37]</sup> Patton, 2002).<sup>[40]</sup>

### 3.6 Data Analysis

Constant comparative method was used to analyze all sixteen transcribed interviews (Johnson & Christensen, 2008;<sup>[25]</sup> Kvale, 2009;<sup>[31]</sup> Miles, Huberman, & Saldana, 2014).<sup>[36]</sup> Audio recorded interviews were transcribed. Data were reviewed several times and a master coding list was developed, a process known as “initial coding” (Saldana, 2012, pp.100-101).<sup>[43]</sup> Interview transcripts were further read, internationalization related documents and institutions’ websites were reviewed several times and more descriptions were added to initial codes. Next, relevant quotes were extracted from transcripts to support the codes. Afterwards, responses were categorized into themes, a process known as “axial coding” (Saldana, 2012, p. 209).<sup>[43]</sup> Next, conceptually clustered matrix (Miles et al, 2014) was adopted for cross-case analysis. Six cell entries were identified— “themes, quotes, names, differences, similarities, and short narratives” (Miles et al., 2014, p. 175).<sup>[36]</sup> Results that emanated from the cross-case analysis were compared to the theoretical framework and relevant previous literature to highlight consistent and contradictory views.

### 3.7 Positionality

The first author conducted all the interviews and as an international student, she was considered an insider and the insider perspective enhanced a better understanding of the perspective of the participants (Sprague, 2005).<sup>[47]</sup> Also, as an international student, she easily struck rapport with the participants that made participants comfortable to share their understanding on how institutional culture contributes to promote internationalization (Mann & Stewart, 2000).<sup>[34]</sup>

### 3.8 Findings

The study explored students’ understanding of how organizational culture contributes to promote higher education internationalization through events that occurred at two U.S higher education institutions. Research question that guided this case study was: what are students’ understanding of how organizational culture contribute to promote internationalization? Findings showed that organizational cultural practices such as integration into university family which included support provided to students. Both universities provided health, financial, academic, immigration, housing support to international students as a way of integrating international students into the university family. Additionally, presence of institutions’ leadership

personnel made appearances at international student gatherings as a way of supporting international students. Also, both institutions had a culture of communication where information about internationalization were communicated through emails, newsletters, flyers, banners, word of mouth, institutions’ homepages, electronic bulletins, and social media such as Facebook and twitter. In addition, community relationship culture was evident in the existence of partnership between both institution and other institutions across the world. Further, buffering culture described both institutions, as internal resources were harnessed for internationalization.

## 4. Integration into University Family

Integration into university family culture characterized MWU and ECU. Both universities provided international students with pre-arrival and post-arrival support. Pre-arrival support consisted of processing the applications of prospective international students and informing students about admissions outcomes. I-20 is a— “document issued by a school [to be used to assist a [student] in the attainment of a student visa and maintain nonimmigrant student status while in the U.S” (Farnam, 2005, p. 63)<sup>[18]</sup> are issued to successful applicants. Post-arrival support included orientation, academic, financial, housing, and health. At orientation, international students at both institutions were informed of U.S. immigration rules to help them stay legal in the U.S. Immigration support was offered to international students throughout their studies until graduation. International students from both universities constantly received emails to keep track of I-20 expiration dates for appropriate action to be taken. Travel signatures were given to international students travelling to their respective country to avoid being denied reentry into the U.S. Appropriate guidelines to follow to get a legal work permit in the U.S after graduation were available to international students. International students who wanted to bring their spouses to the U.S received immigration support. “[providing] letters so the [international students] can issue I-20 for their [dependents]”, Laura said. Similarly, Melody said that, “a lot of [international students] come [to the International office] to ask questions about immigration, we try to help them as much as we can ...”. Equally, Jerome said, “staff at the international office advise us and provide us with information on how to maintain immigration status”. International students at MWU and ECU received formal and informal forms of academic support. International students with low English proficiency had the opportunity to improve their English through formal courses and informal activities such as access to conversation hours with native speakers of U.S American English. To corroborate

orate this perspective, Roland, said, “when I first came to [MWU] I knew zero English but through the academic [writing] class I [took] and I started interacting with [Americans,] through the conversation partner sessions, I improved my English.” Similarly, Angela of MWU indicated that,

I took a lot of classes with ELIP for graduate students who want to write dissertation. I took that class, which was helpful, the tutors ... are helpful ... so that is the services that I used. About the research in Engineering and Biomedical I have seen a lot of international students especially from India and from China, so I feel they have been helpful to international graduate students.

Another academic support that international students received was how to register for courses, how to use the library resources to search for information as well as how to avoid plagiarism. A unique academic support that described ECU was the policy that required international students to introduce themselves to their professors the first day after class. To enforce student-faculty compliance, both parties, were required to sign a compliance form and submit same to the office responsible for student retention. Additionally, comparable to both universities, international students received, financial assistance. Financial support included Graduate or Teaching Assistantships for international graduate students. Unlike MWU, ECU provided out of state tuition waivers for international undergraduate students. Also, synonymous to ECU and MWU, international students had free access to counseling services throughout their studies. Guidelines on how to get health insurance to be able to access health centers at both campuses were synonymous to both universities. MWU—health center provides international students with information in “Arabic, Japanese, and Chinese. So, they have their different brochures in different languages. So, they have improved a lot. When they do orientation with [ISFS] [the health center] will have their brochure in different languages”, Laura said. Housing support to international students was apparent at ECU and MWU that indicated a family-oriented culture. During Easter, Thanksgiving, Christmas, and spring holidays, international students lived in the dormitories. However, female Muslim international students at ECU revealed they felt uncomfortable residing in the dormitory because American women received male visitors at the dormitory, when there were times that their hair was not covered. This was evident in a statement from Emily,

we had a case where there was a Muslim students who was living with an American student and she was uncomfortable with her [American roommate] bringing men into the apartment because she takes off here hijab and in her

culture men are not supposed to see her hair and so she will be walking to the kitchen and viola there is a dude, and to a lot of Americans, it is not a big deal but to her it was a big deal. It is hard when in housing it is just Americans working there and they do not get it, yeah, a guy came in but did not harm you.

To address the cultural differences between the Muslim and American roommate ECU paired students with the same culture and faith as was evident in a statement from Emily,

They have set aside building for international students. Mostly international students who are going to live there and try to make sure ... a lot of international people especially if they are from the same area or the same type of culture, they fit better with each other because they understand. Muslims from Tunisia and Muslims from Saudi Arabia are going to understand that we cannot have a guy here when we have taken off our hijab as opposed to her living with an American.

Also, some form of cultural sensitivity is provided to Americans and international students as was crystallized in a comment from Emily,

we have a program in the housing ... so they try to create that sensitivity in the housing area and they also try to create events so that the students get to mingle and know each other so that we break down those walls between Americans and some international students.

Parallel to both universities, to address the needs of international students, international offices were staffed with adequate and competent personnel. Converse to MWU, the director at the retention office, can metaphorically be described as a mother to students which reflects the family culture. Because her services to students went beyond her official duties as was evident in a statement from Emily, “[the director for retention] when I came to ECU at first. I sat in her office and talked for hours [till] 9pm or 10pm. She will just help you, ask you about your classes”.

### ***Presence of Institutions’ Personnel***

Presence of institutions’ personnel at international gatherings at MWU and ECU demonstrates a family-oriented culture. Evidence of institution personnel at international students’ gatherings were clear in a statement from Michael of ECU,

I remember we had an event where [the president] ... and his cabinet visited the global village to speak with us. He asked us about our challenges. ... [some] people said the money and the classroom issues. He listened and responded.

Also, Angela of MWU reported that “... every year the International Street Fair has its own community that will



go there no matter what like faculty, the [President] and his wife. ... They know what they want to see.”

## Communication

Synonymous to MWU and ECU, emails, newsletters, flyers, banners, posters, institution homepages, electronic bulletins, word of mouth, and social media—Facebook, and twitter were the media adopted to communicate internationalization activities to students. Edward from MWU mentioned that, “students see so many bulletins, posters, and flyers on study abroad, international student dinner, and Holi Divali”. Similarly, Hammond from ECU said that “there is a communication structure where people can know that events are happening. ... A major event that happens on campus that gets published in *ECU Inform* was the *Year of program*.” Additionally, Kelsey from ECU said,

I mean ECU promotes events very well. They send emails to our students email all the time hey this is what is coming up this week or next week so enjoy. ... It is very useful. At least the communication lines are good. Flyers, brochures, banners, and social media that is Facebook. The international students’ association at ECU, the global village and the international students and retention services office promote international events.

Similarly, Melody commented that, like the ISA events it is the people who sign up to be in ISA that get these emails or the people who are on the Facebook pages so the people who are on the global village home page they are the people who will mostly get the emails. ... so anytime someone walks in we tell them about ISA and tell them to sign up One thing that I know of is the posters. If you walk around campus, you will posters on different offices, that, say year of Japan and these are the programs, that will go on for the whole month and I know they work with some professors. Those professors are also instrumental in announcing it to their classes.

## Community Relationship

Community relationship underpinned ECU and MWU internationalization. Evidence of community relationships include existence of partnerships between both schools and institutions worldwide. Partnership between both universities and institutions abroad were highlighted in a comment from Courtney of ECU, “as a student working at [the] study abroad [office,] when they were signing agreements with universities in Kenya, Ghana ... and Turkey, I worked on some of our agreements.” Also, Angela of MWU reported that “I got involved in a committee called University International Council. ... We gather once a

month to review the MOU with universities [abroad] so I saw some from Malaysia ...” Also, both institutions depended on destinations of study abroad programs as resources within the environment to expose students to the world. Unlike MWU, ECU organized “*Year of*—an annual campus-wide immersion and interdisciplinary program that involved selecting and learning in-depth about a country for an academic year. Community relationship culture is evident in the way citizens of the country of focus are invited to come and interact with students through guest lectures, panel discussions, and cultural activities such as music, art, and food. Considering that *Year of* is meant to educate students and broaden students’ international perspectives, it is mandatory for all freshmen to attend *Year of* programs and write one to two-page reflection paper and relate it to their major for a grade. Strategy to ensure full participation in *Year of* program was apparent in a statement from Michael,

I got involved in the *Year of* Romania events, because, we had a class assignment to [attend an] event. [My professor had it on the] curriculum and students had to write a page or two-page papers about [their] experiences, thought, feelings. It is subjective ... [professors] made sure that [students] are writing something meaningful ... so it is graded mainly [on the] content.

Similarly, Agnes of ECU said, “faculty require students to be at the lecture as part of their course work to make sure they are there”. Equally, Courtney of ECU said,

[During] undergraduate, [students] had to attend the swirling dervishes’ performance and relate it to [the] TPS 1000 theater class. ... [Students] must write a paper about the performance and how that connects to their class. The activities line up for the *Year of* program were tailored [towards] the needs of students.

Also, Melody said, Once I went to the *Year of Korea* program, [because] I [heard] Hangeul. I have never heard a word like this and that is the Korean writing system, and they were talking about how it was invented, and they were talking about why ... most Koreans are not able to differentiate between pronunciation of the r and l and the p and b and I was like this is like people in Kenya, to them it is the same sound. I reflected on some tribes in Kenya, and I made some connection so there is something for everyone ...

A review of the *Year of* program online and flyers confirmed that—Japanese Culinary Services, Political Structure of Japan, Japanese technology as well as History of Ghana were designed for students during the *Year of Japan and Ghana*, respectively.

## Buffering

According to Lynn (2005)<sup>[33]</sup> buffering is the regulation and /or insulation of organizational processes, functions, entities, or individuals from the effects of environmental uncertainty or scarcity. Buffering culture described both institutions, as internal resources were harnessed for internationalization. International students recruited to both campuses were given the opportunity to form clubs and associations. These clubs and associations organized cross-cultural events making the buffering culture obvious. Intercultural events common to both institutions were international dinner and international food bazaar where students got the opportunity to sample food. Additionally, international students were engaged as Teaching and Graduate Assistants to assist in instruction and research. This buffer culture was evident in a comment from Melody, “teaching assistantship are usually given to grad students, PhD students by the various departments. Also, like I noticed there is geography teachers who always request people to come to talk about their countries or their regions”. Similarly, Lois commented that,

My Geography classes, the professor was so excited to have international students in his class. He asked us to do presentations about our countries for the class ... because it was a Geography class it was appropriate Other professors did that ... I have been [invited] and I have told them about the head gesture and everybody [was] just amazed. ... Consumer class have also asked international students to come and speak about marketing and consumer practices in their home countries. Also, they asked international students to come and tell the class about who makes the purchases in their home countries? Who is the main person that goes to the stores and makes the purchase? Who gets the money? What is the main product that is purchased by men and women? Is there a difference?

Buffering culture, distinct to ECU, was the Global Learning fee of US\$14.00 that was charged to students’ account every semester. This fee constituted the Global Learning Fund. Study abroad participants received US\$600-US\$2100 from the Fund. Buffer culture through global learning fee was illuminated in a comment from Melody,

Every student as part of our student fee we pay global learning fee which is \$14 that goes into a big pool of funds and any student that goes on a study abroad program if they are eligible, they can receive a study abroad scholarship that is given from this global learning fund. Eligible student receives \$600.

## Symbols

Flags of different countries hoisted at strategic locations at both campuses suggested symbol culture. Engraving of a globe at the students’ center at MWU and a monument of a globe at ECU demonstrates a symbol culture. Presence of international offices clearly suggests symbol culture at both universities. Comparatively, ECU had an office solely responsible for international student retention. Situated at the retention office, was the Global Village. The Global Village served as a hangout location for international and domestic students. However, the study revealed that not much domestic students socialized at the Global Village because they felt it was reserved for international students. International students referred to the American flag at the global village to encourage domestic students to understand that “the Global Village is for everyone, it is not because you see different flags then it is for international people, [American] flag is there, it is your place too.” Lois said.

Students from both institutions reported that they received certificates for global learning, knowledge, and skills. Students of MWU took global engagement courses and interned abroad to qualify for Global Learning Certificate, whereas students of ECU took Global Engagement Courses, studied abroad, and submitted essays about their reflections abroad.

Additionally, while students at ECU were awarded medallions at graduation ceremony for global learning experience, global coursework, education abroad, and cross-cultural experiences, this was not the case at MWU.

### Shared Values and Beliefs

Shared values and beliefs underpinned the culture of both universities. International offices at MWU and ECU collaborated with health services, residential services, transportation services, immigration lawyers, and banks to provide support to international students. Similarly, the practice of permitting announcement of international programs in classrooms by faculty suggests a common belief and value for internationalization. Unlike MWU, at ECU, shared values and beliefs was evident in the collaboration among the various international offices and other academic units during *Year of Program*. For instance, the Education Abroad Office and the departments of History and Modern Languages collaborated to design courses on history of Ghana, Japanese culinary services, political structure of Japan, Japanese technology for Year[s] of Ghana and Japan, respectively. Evidence of collaboration among offices was highlighted by Patrese,

During orientation, [International office] invites every department to participate so [newly admitted international

students] will know what departments are [on campus] what organizations are on campus. Usually, the transportation services, legal services, women center, the bank as well so I can tell that the involvement of this departments shows their interest in serving the international student population

Also, Melody commented that, “international office collaborated with History Department to develop courses such as History of Ghana, Japanese culinary services, political structure of Japan, Japanese technology to help students develop interest in Year of.

## Steering

Creation of leadership and administrative positions in the structure of both institutions suggests that steering culture underpinned the internationalization processes. The researchers discovered that there were positions of the Provost for global affairs at MWU and Vice Provost for Strategic Engagement and Global Initiatives at ECU. Position for internationalization officers at both institutions was highlighted in a comment from Angela, “I feel ... they have ... great commitment especially having a position for Vice Provost for global affairs”. However, administrator turnover at key internationalization positions was evident in Angela’s comment:

There is too much [administrative] turnover position ... and I am ... sad. They could not afford to have great people because the great people were here. But [MWU] could not offer more to make them stay ... maybe it is political or money issues. I am sad because it happened to different administrative positions.... [for instance] at the Center for International Studies. ... I know some ... good professors [who], are [no more] here ... Great people came, [with] great ideas [and] implementation.

## 5. Discussion

Pre-arrival and post-arrival support provided to international students from both universities is consistent with previous studies that shows that host universities identify and address the needs of international students (Farnam, 2005;<sup>[18]</sup> Schin, 2015;<sup>[45]</sup> Rodenberg, 2010).<sup>[42]</sup> Formal and informal support services offered to international students with low English proficiency is consistent with Tsang (2002)<sup>[51]</sup> assertion that institutions should be sensitive to international students’ communication challenges and provide support. Post-arrival support like the policy that required international students to introduce themselves to their professors on the first day of class suggests that the academic needs of students were incorporated into the curriculum to ensure international students succeed. Interna-

tional students’ success is critical to transition, adjustment, retention, curriculum enrichment, improved cross-cultural knowledge, skills, and understanding among students as international students carry with them their cultures and experiential learning to their host nations (Bond, 2003;<sup>[8]</sup> Ukomadu, 2010).<sup>[52]</sup> Value for international students’ success is critical to achieving institutions’ internationalization goals.

Several researchers agree that international students often face financial challenges in their pursuit for higher education outside their home countries (Astin, Oseguera, Sax, & Korn, 2002;<sup>[4]</sup> Goyol, 2006;<sup>[21]</sup> Mori, 2000).<sup>[38]</sup> Consequently, scholarship offered to international graduate and undergraduate students supports Ukomadu’s (2010)<sup>[52]</sup> findings on financial assistance given to graduate and undergraduate students in U.S universities. Furthermore, health insurance support available to students of ECU and MWU to enable them access health centers at both campuses is consistent with Ukomadu (2010).<sup>[52]</sup> Also, consistent with Schein (2010)<sup>[44]</sup> artifacts framework, international students were provided with housing support. However, the solution proposed to resolve non-Muslim and Muslim roommate incompatibilities is likely to perpetuate clumping—a condition that can hinder dialogue for cross-cultural and interfaith understanding. Global Gateways: A Learning Community for International Students initiative, designed to help international students manage homesickness is consistent with previous studies that recommends that intervention programs such as social gatherings are critical to relieving international students of depression, boredom, hopelessness, lack of self-worth, anxiety, and alienation (Ukomadu, 2010).<sup>[52]</sup>

Presence of institutions’ senior level administrative personnel at international gatherings highlights family culture and suggests support for internationalization at both campuses (Lunenburg, 2011;<sup>[32]</sup> Rodenberg, 2010).<sup>[42]</sup> In addition, leadership presence, gives international students a sense of belonging and acknowledgement which might positively impact international students’ enrollment, because international students might serve as recruitment agents in their respective countries (Arthur & Flynn, 2011).<sup>[3]</sup> Additionally, international offices staffed with adequate and competent personnel to attend to the needs of faculty, students, and staff confirms Rodenberg (2010)<sup>[42]</sup> and Knight (2004)<sup>[28]</sup> recommendations. Attitude of some university personnel to support students beyond official business hours mirrors a family-oriented culture (Lunenburg, 2011)<sup>[32]</sup> that prioritizes the welfare of international students. The revelation that students complained of hearing about international events after they had occurred at MWU suggests poor participation in international activi-

ties, hence, mode of communicating internationalization events need to be improved.

Collaboration with the external community to expose students to intercultural and international perspectives through Year of supports previous studies that found that collaboration with the environment is critical to students' intercultural and international competencies (Bartell, 2003;<sup>[5]</sup> Casciaro & Piskorski, 2005;<sup>[11]</sup> Guo & Acar, 2005)<sup>[22]</sup> making community relation culture critical for internationalization (Bartell, 2003).<sup>[5]</sup> Requirement for students to write a reflection paper on Year of program attended will motivate students to participate in international events to broaden their international perspectives. Also, buffering culture evident at both institutions confirms Hoy and Miskel (2008)<sup>[24]</sup> assertion that institutions continually face disturbances from the environment. Therefore, both institutions harness the skills of international students as a buffer (Thompson, 1967;<sup>[49]</sup> Lynn, 2005)<sup>[33]</sup> to support faculty in teaching, administrative duties as well as fostering cross-cultural knowledge and competencies. These internal arrangements confirm Bartell's (2003)<sup>[5]</sup> suggestion that looking inward is pivotal to successful and sustainable internationalization. Consistent with Siaya and Hayward (2003),<sup>[23]</sup> all the observable evidence of internationalization such as global learning certificates, medallions, flags, engraving of a globe, monument of a globe (Schein, 2010),<sup>[44]</sup> and international offices at both universities, suggests commitment to internationalization. Provision of a space for Global Village confirms Schein's (2010)<sup>[44]</sup> claim that space has a "social meaning" (p. 96) because the Global Village served as a venue of support and networking among international and domestic students (Kezar & Eckel, 2005).<sup>[26]</sup> Additionally, flags appear to be powerful tools that both institutions use for internationalization. Provision of funds depicted senior level administrators' support for internationalization (Knight, 2004;<sup>[28]</sup> Rodenberg, 2010).<sup>[45]</sup> Inspiring and motivating students' engagement in internationalization through awarding certificates and medallions confirms earlier research that rewards can inspire people to engage in internationalization (Bolman & Deal, 2003;<sup>[7]</sup> Schein, 2010;<sup>[44]</sup> Rodenberg, 2010).<sup>[42]</sup>

Integration of international students into the university, permissions granted to students to announce international events in classrooms, collaboration among the various international offices and other academic units during *Year of Program* suggests a shared value and belief to imbue international perspective into students. Thus, successful internationalization thrives on shared values and believes among faculty, administrators, and students (Bartell, 2003;<sup>[5]</sup> Schein, 2010).<sup>[44]</sup> Existence of positions for global affairs officers at both institutions highlights "division of

labor" (Schein, 2010, p. 56)<sup>[44]</sup> for the internationalization of both research sites, however, senior level administrators' turnover is likely to impede internationalization.

In conclusion, results of this study showed that visibility of senior level administrators at international students' gatherings reflects, appreciation of students' efforts as well as leadership commitment to internationalization. Also, communication culture is vital to campus internationalization at both campuses. Community relationship culture characterized both schools because both institutions depend on external resources to execute their core functions. Examples of such resources include partnership with local and international communities through MOUs, study abroad programs, and *Year of program* study African languages through Foreign Languages and Area Studies Fellowship. Also, considering that the functions of institutions can be influenced by disturbances in the environment, buffering culture based on cross-cultural events, offer of assistantships to international students to teach African languages and the institutionalization of a global learning fee charged to students' account every semester to support study abroad is critical for internationalization. Tangible elements of culture that indicated internationalization in both schools were international offices, flags, globes, presence of ISRS, global village, and the award of medallions to acknowledge students' global learning achievements contributed to internationalization. Family culture exhibited through support for international students is critical to successful internationalization. Finally, shared values and beliefs underpinned the culture of both schools. Collaborations among international offices and other departments and units on campus as well as external entities to bring international students to campus and integrate them into the U.S educational system substantiate shared values and beliefs, thus, makes ECU and MWU alike. In terms of how this study is useful for practice, institutions seeking to internationalize through international students' recruitment should be sensitive to international students' needs through family culture. To curb roommate conflicts, personnel at the residential halls should not adopt same background pairing, instead, they should be trained in cross-cultural awareness and sensitivity to be able to train students at the residential halls for peaceful co-existence. To increase students' engagement in internationalization activities, faculty should be informed to encourage students to participate in international events (McCormack, 2013).<sup>[35]</sup> Institutions seeking to prepare graduates who can effectively function in a multi-cultural setting, community relationship practice through partnerships with institutions abroad, engagement with local and international communities are highly recommended.

Therefore, institutions should recruit international students and tap into their cultural and experiential knowledge. Higher education institutions can incorporate the Global Learning Fund into internationalization practices to support students' international travel. Flags of different countries should be hoisted at strategic places on campus to create a sense of belonging, and awareness of internationalization. Finally, because administrative turnover is likely to hamper internationalization, institutions should incentivize administrators to ensure staff retention. For future studies, research that explore students' understanding of how organizational culture contributes to university internationalization should be done in Africa, Asia, Australia, and South America using mixed method approach to provide better understanding. This study has some limitations because findings emerged from sixteen participants from two U.S universities. Consequently, findings cannot be generalized to all universities in the U.S considering the small sample size (Creswell, 2014).<sup>[14]</sup> Therefore, future studies on students' understanding of how organizational culture contributes to university internationalization should draw on a larger sample size which can be generalized to all universities in the U.S.

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ARTICLE

# Conceptual, Operational and Policy Issues in Servicing Gifted Students in Mexico

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ABSTRACT

This paper reflects upon existing conceptual controversies regarding high ability students in Mexico. A taxonomy of high ability students is proposed with the aim to provide clarity between the categories of talented and gifted students. Differences in services needed in each category are addressed considering implications for teacher training and educational policy. Problems in policies regarding gifted students are analyzed. As a result, arguments on why gifted students should not be classified within the special education services are posited. We argue the importance of independent services for the gifted supported by their own theoretical and methodological framework. Educational policies based upon potential, talent and merit are necessary to foster the human capital of the county. We argue that the effective of screening and intervention of Mexican gifted students is a sound strategy to enhance socioeconomic and scientific development, thus a sound reason to invest in the brilliant minds of our students.

## 1. Introduction

In Mexico, and perhaps in the Spanish language, there are many confusions in the use of labels to categorize talented and gifted students. The aim of this work is to clarify these terms and concepts for use in elucidating their implications in the field of the gifted education. A distinction between talented, gifted, and high achieving students is the first step to clarify between categories of students that have different educational needs. An efficient and simple taxonomy to identify the educational needs of talented and gifted student is a sound policy for serving them. Thus, in this article we will clarify the nomenclature

for identifying students' high abilities as talented, gifted, or high achieving students.

The term *high ability* has been universally used as a mixture of talents, efforts, and intellectual gifts. This is because of the influence of Renzulli in the early years of gifted education in Mexico, who proposed that gifted and talented individuals conjugate creativity, skills, and task commitment. This definition is so broad it created confusion when categorizing different kinds of students' abilities. This inclusion of a rather broad set of characteristics to consider giftedness has inspired many programs around the world, but it has also created some confusion as to

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who is gifted (Sanchez, 2013)<sup>[13]</sup>

This paper focus on the conceptual ambiguity and lack of specific guidelines to address gifted students in Mexico and its implications for educational policies and practice.

## 2. Definition and Classification

In Spanish language educational literature, one encounters inconsistent and changing terms in referring to high ability students. Furthermore, there are several labels that have little value for classification purposes. Sanchez (2003)<sup>[14]</sup> argued that some terms must be avoided, such as *prodigious*, referring to those who have extraordinary abilities in a specific field such as arts, sports or memorizing. *Precocious* which refers to children who develop skills earlier, for example, who learn reading and writing at age four. Or *genius* which is a term used for persons noteworthy for their creative or inventive capacity. Other terms must also be avoided such as *outstanding*, *highly able*, and *exceptional* simply because they lack precision to define what are the assets of specific students in each educational setting.

The most used term is *talented* which refers to the ability to master tasks in an exceptional way in one or more fields of activity, like arts or sports. In this sense, the term *talented* refers to the ability or having either a physical or an aesthetic ability, or both. Thus, the potential to excel in arts such as dance, music, poetry etc; or the physical ability to excel the field of sports. In general, it is accepted that a talent is identified if exercise and practice sharpen one or more skills; therefore value is granted to a student through environmental influences either in the family, the school, or the social context (Lizcano & Sánchez-Escobedo, 2016).<sup>[10]</sup> Of course, in some cases, talent is still a blurry definition, take for example mastering ballet, typically considered a belle-art, but that requires exceptional physical strength and condition. In this field, both aesthetic and physical abilities are needed to excel.

The problem with the term talent is the inability of servicing these students within Mexican schools. As well as in many other countries, talented individuals require extracurricular activities either in the arts or competitive sports. Special facilities, materials and even unconventional lifestyles are required to foster these talents and educational needs are very often met by curriculum adaptation and specialized educators. Since our focus is servicing cognitive highly able students within the established educational system in Mexico, we do not address talented students in this discussion.

In this perspective, intellectual high ability or giftedness refer to students with high academic potential in school and requires special challenges to avoid boredom and underachievement. The student with high academic potential needs to be differentiated from students with *High Academic Performance*, student who stand out in the school settings because of their effort and good grades. Typically, they have normal intelligence and their performances have placed them in the high percentiles of the grade's score distribution (Camelo, 2018).<sup>[3]</sup> In Mexico, teachers need to be aware, that despite the excellent prognosis that high achieving students have for success, the term gifted does not apply to these students.

Thus, high cognitive skills should be considered a sub-category of high abilities that assumes an innate cognitive ability or general intelligence that is independent from sex, economics, race, and location. It is important to point out that the epigenetic aetiology, minimizes environmental influences children are born with is a gift; hence they are referred as *gifted* in the English literature. This argues for the need of intelligence testing that places them above the 97 percentile on the standardized scale. Determining a high 'g-factor' of intelligence is the most consistent and incontrovertible practice to screen for gifted students around the world (Labastida 2014).<sup>[9]</sup> Camelo (2018)<sup>[3]</sup> asserts: "The key to conception of giftedness should bear in mind the resources which can be used according to the demands that the environment presents. The greater the number of intellectual resources, the greater the probability of adjusting to the demands of the environment" (p.61).

Although many educators have displayed reservations and resistance to accept that schools can't convert any child in gifted, the recognition and acceptance of this fundamental fact makes it easier to understand many of the limitations, prejudices and challenges in servicing the gifted. In Mexico it is important to prevent the abuse and fraud of persons. Institutions of education must be reject the exploitation of dedicated kids whose parents' have enormous expectations by offering magical solution and ways to "promote" giftedness along an extensive financial gain. Table 1 illustrates terms used in hope of clarification and definition of various terms used in a parsimonious way.

The focus of this work is the category of giftedness, students with high cognitive abilities and exceptional intellectual potential. We will discuss further the specific screening, intervention, and policies regarding this specific group of students.



**Table 1.** Classification of Students with High Abilities

Concept	Domain	Features	Services/intervention
Gifted	Sciences, technology.	High IQ-Intelligence	Acceleration, enrichment etc.
High achieving	School performance	Effort	None
Talented	Sports	Physical abilities	Sports centers, training.
	Arts	Aesthetic potential, creativity	Fine arts, special academies.

### 3. Identification

In Mexico, systematic screening for gifted students is an infrequent activity, despite the importance which it has for the development of human capital and human resources. Mexican educators have failed to foresee the value of servicing gifted students and to guide and support these children to the highest levels of education. At a national level, there is a lack of standardized methods, instruments, and procedures for screening gifted children. Likewise, there are few specially designed programs and strategies to meet their educational needs (Sánchez, 2006).<sup>[15]</sup>

Obviously, this is due to the conceptual controversy in defining who is gifted and the lack of teacher training in this field. In addition, there has been confusing information on who they are and how to serve them. Thus, many programs and activities based on enrichment and directed to all kinds of children has been the trend; instead of using specific proven strategies of intervention (Sanchez-Escobedo, Acle-Tomassini, De Agüero, Jacobo, & Rivera, 2003).<sup>[14]</sup>

Classification is the key service required which ensures that program resources are directed to the gifted students are not dispersed. In Mexico, many programs based on small classes and specialized professors were filled with children that were not gifted, not even high achievers. They were children of other teachers and authorities. In sum, materials, and resources for gifted education, were used for remedial or enrichment purposes, perhaps with no harm done, but certainly without purpose and long-term goals for those gifted.

### 4. Intervention

A simple taxonomy and conceptual clarity about who is gifted is important for effective screening. Intelligence testing should be done in a systemic fashion, particularly in a country in which teacher nomination usually identified high achieving students as gifted (Sánchez-Escobedo, 2006).<sup>[15]</sup> Such classification is necessary to rationalize practices in Mexican schools.

We need a simple and practical classification of High ability students because of the educational implications for teachers. For example, high achieving students must be motivated to continue their path to excellence. Talented students should be directed to the specific spaces where their abilities can be fully developed, usually beyond the school in sports centres or academies of art.

Gifted students however, require special attention to keep them challenged within the school system (Colangelo, Assouline, & Gross, 2004).<sup>[5]</sup> Labastida (2014)<sup>[9]</sup> points out a series of necessary instructional considerations for teachers in Mexican schools.

1. Their learning must be of significance and consequent to their capability.
2. Teaching must be done with diverse methods.
3. The control of learning must be passed in a progressive fashion to the hands of the students.
4. Teaching is not meant to transmit knowledge, but to facilitate the learning process.
5. Students must be active participants.
6. Multi-disciplinary approaches must be considered when designing instructional activities (p.28).

Beyond these tenets useful in the traditional classroom, other scenarios must be considered. Here are the most used actions in educational systems around the world.

#### 4.1. Acceleration

Acceleration has been considered the most cost-efficient intervention (Becker, 2007)<sup>[11]</sup> (Gallagher, 2002).<sup>[8]</sup> Its main objective is to challenge the intellectual ability of the student. There is evidence on the efficacy of 18 methods of acceleration, among those skipping grades, studying a specific subject in higher grades, self-paced instruction, curriculum compacting, early admission to university etc. The reader can refer to the Davison Institute for further information (<https://www.davisongifted.org/search-database/entry/a10313>). Many prejudices and resistance of teachers to accelerate gifted students were thoroughly addressed in the key publication on this topic *A Nation Deceived* (Colangelo, Assouline, & Gross, 2004)<sup>[5]</sup>

## 4.2 Enrichment

In Mexico, the most used strategy has been the enrichment, historical practiced from the movement of progressive education in North America in the 1920's which proposes to educate outstanding children through a profound education which derived during the cold war into a method of grouping students according to their abilities (Labastida, 2014).

When reviewing the different state and federal programs for gifted students among the most common are additional classes, guided tours, field trips, summer camps, and guided travels short-term enrichment activities. Most of these programs have poor consistency over time.

Enrichment attempts to stimulate students and influence their vocational choices through a wide range of activities. Activities usually aim to promote interest in sciences, technology, or leadership. This is a popular alternative that usually leaves unforgettable memories in participants that attend field tips, summer camps, travels, excursions, and cultural visits among many other activities. In Mexico, many estates have carried about such programs but follow up studies have shown that these programs are usually costly and do not have a significant impact on the students' academic performance and vocational choice (Davis, 2006).<sup>[6]</sup>

Additionally, some elite programs have high costs which makes them difficult to maintain. Bigger programs such as NASA, University of California, and the Belin-Blank centre in Iowa have discontinued because of costs and changes in administration. Similar stories can be observed in the participation of competitions, creative festivals and knowledge Olympics.

## 4.3 Individual Activities

In some cases, schools design some additional activities for gifted students. This is usually carried out by a tutor who designs activities according to the interest and capacity of the student. In addition, these programs may consider independent studying; reduction of classes, pacing instructions faster, and using materials of higher levels. Unfortunately, in Mexico, most of these activities have been reported in an anecdotal fashion and we lack empirical evidence on the use and effectiveness of this approach.

## 4.4 Grouping

The grouping according to the capabilities in school or special classrooms are more popular in Europe. Students

are carefully selected and cluster by area of expertise (mathematics, languages, etc.) or by level of ability. In those schools there are itinerant teachers, extra work in classes and special seminars (Castanedo, 2006).<sup>[4]</sup> This common practice in European countries is not available in Mexico.

## 4.5 Online Learning

Finally, and because of the pandemic situation. Many online activities have emerged on Mexican websites. One example is *El Centro de Attention al Talento*, a private website directed for gifted students and their parents that offers diagnosis and in intervention of giftedness <http://www.cedat.com.mx/es>. However, no empirical evidence has been collected to assess its impact and influence in gifted children. In addition, services have a rather high cost that not every Mexican family with a gifted child can afford.

## 5. Policy Issues

There are important policy considerations in servicing the gifted. Two major issues should be discussed, the first has to do with situating services for the gifted in traditional special education services, the second is the lack of a strategic vision in the Mexican state to foster and nourish the intellectual capital of the country.

### 5.1 Special Education?

The inclusion of services for gifted children in Mexico has met criticism and there is an emerging movement to create a new category of service, specifically for the gifted that encompasses its own theoretical and methodological framework (Valadez, Betancourt, & Zavala, 2012).<sup>[17]</sup>

Beyond the simplistic statement of seeing these students in the opposite extremes of intelligence scores in the Gauss curve, the differences in the educational care of gifted and students with disabilities needs to be explicit and evident. On one hand, students with disabilities require special support outside of the classroom depending on the type and level of the disability; they usually require special resources and materials, and the cost of services is generally high. In contrast, gifted students can be advanced within in the same school and they seldom required special materials. They neither present problems with integration; thus, costs are low since the same school infrastructure is used for acceleration. Table 2 summarizes differences between gifted and students with a disability and their educational needs.

**Table 2.** Comparison of the Needs of Students with Disability

		Needs	
		Disability	Giftedness
Mobility	Relocation of the ground floor for students with disability motive or visual to access those. Adaptation of handrails in the restrooms for students with mobility disabilities. Elimination of physical obstacles (garbage cans, pots and furniture) which limit the freedom of space int the school or classrooms		None
Communication and Information	Adaptation of educational material which respond to the specific needs of each country with certain disabilities students (visual, auditive, intellectual). Elaboration of boards of personal communication		None
Material and technical support	Walking stick, crammer, calculator, magnifying glass, macro types, and others. Perkins machine, abacus ruler, prick, cashier computer adapter. Auditive helpers, visual material, FM system, and others		None
Sites of care	In the school, in special centers, etc.		In the School

From a pedagogic point of view, there also seems to be discrepancies between the purpose of care for gifted students and students with disabilities. Special education services are meant to minimize or eliminate barriers for learning where as services for the gifted focus on fostering their maximum cognitive potential and to avoid the boredom preventing academic failure. (VanTassel-Baska & Stambaugh, T., 2008).<sup>[18]</sup>

In Mexico, we need special and independent services for the gifted. We argue that the gifted children should be served by specialized services that can diagnose and select the appropriate intervention for the gifted. Services must employ knowledge and resources to carry out a formal program for gifted students within the school system.

**5.2 A Human Capital Perspective**

Ostrom, Ahn and Olivares (2003),<sup>[12]</sup> posit that human capital is the knowledge and the accumulated abilities in a community of its members in a conscious way, either through education, qualification or experience. Educational policies in Mexico should recognise the strategic value of screening and cultivating the potential of gifted children for the economic, social, technological, and scientific development of the country. These Mexicans represent a form of human capital for the nation, as such it constitutes a portion of the country’s wealth which has been overlooked.

Policies to address the educational needs of gifted students have been successful in many countries because of their impact on the national development. The economic

success of the people, depends on how extensive and effective they can invest themselves (Becker G. S., 2002).<sup>[2]</sup> Furthermore, the advancement of science and technology, the preservation of health and the care of the environment depend upon the amount of human capital in a community. Human capital is a fundamental asset in a knowledge-based society .Gallagher (2002)<sup>[8]</sup> warned on the cost of having a national public policy which ignores policies to serve the gifted will have a negative impact on the economic and social development of a country. He argues that governments with a vision of the future must foresee strategies for the technical assistance and the preparation of persons in charge to develop talents and substantial funds for the development of human capital must be invested. This continues to be a pending issue in Mexican educational policy.

In Mexico, laws pertaining gifted educations dates to 1993, in which article 41 of the general education act was amended to add attention to high abilities students as follows:

The identification and the educational care of high ability students, the federal educational authority, based in budget availability, must establish the guidelines for the screening and intervention. By using appropriate pedagogic models, and accreditation mechanisms. Every educational institution in the country should abide to such guidelines. (added paragraph DOF 22-06-2009).

However, such general guidelines have not been translated into specific programs and there is a need to develop a policy that funnels services for the gifted. An independ-

ent entity to oversee services for the gifted is needed. Operational and specific criteria for gifted program must be set to overcome the flows generated by insofar ambiguous educational policies (Labastida, 2014).<sup>[9]</sup>

In creating policies to foster talent and human capital, one must recognize the fact that gifted children are not as common as children with disabilities or learning difficulties. However, their attention deserves state support and recognition of their intellectual potential.

Policies based on egalitarianism maintain that students must have the same opportunities and privileges, this position should consider the educational challenges of gifted children (Márquez, 2010).<sup>[11]</sup> Meritocracy and the recognition of the exceptional intellectual potential in a child should not conflict with visions of social justice and egalitarian trends (Tomilson, 2008).<sup>[16]</sup>

## 6. Conclusions

The conceptualization of high abilities and talented students in Mexico has been discussed for the purpose of establishing conceptual clarity for an effective policy to address gifted. High achieving and Talented students have been distinguished from those gifted in search of a simple but pragmatic taxonomy of High abilities.

Differences between students with disabilities and high cognitive ability has been discussed. The fact that educational services for special needs have historically been organized according to types of disabilities or abilities of students, does not imply that this should be done in the future, particularly in the light of what is now known about teaching strategies and value of gifted students (Florian, 2010)<sup>[7]</sup>

Educational services for gifted students are different than those needed for students with disabilities. Hence, services for the gifted should follow empirically proven intervention methods and stand alone with the freedom to use their procedures for the successful development of these Mexicans' full potential. These students constitute part of the country's strategic human capital, and they warrant specific educational policies that deliver recognition and support.

Mexico's human capital should be expanded by screening and serving gifted students. In sum, we must invest hopes in the brilliant minds in our school system. For this, we need services, policies, and teacher training in this field.

We need to rethink the education of the gifted in Mexico. We need national policies and conceptual clarity to serve gifted students under conviction that they are in a unique position to help solve some of the world's most pressing problems (Webb & Gore, 2011).<sup>[19]</sup>

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