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Motivation: A Key Component for Academic Success

Julio Garay[1] and Jairo Orjuela-Segura[2, 3]

[1]Department of Chemistry, Earth Sciences and Environmental Sciences, Bronx Community College, City University of New York , 2155 University Ave, Bronx, NY 10453, USA
[2]JGO Scientific Learning, [3]Business Administration, University Colegio Mayor de Cundinamarca, Funza-Cundinamarca- Colombia
E-mail: [1]<julio.garay@bcc.cuny.edu>, [2]<jgoscilearn@gmail.com>

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ABSTRACT Lack of motivation, is one of the leading reasons for academic failure, nevertheless, motivation is a multifactorial concept. It could be dissected in its constituent parts: intrinsic, extrinsic, or amotivational and it is certainly associated with a multitude of possible causes. The researchers have used Vallerand's motivational scale to better understand the reasons why their students have chosen to go to school and also to measure the level of interest for mathematics and STEM subjects, so the researchers can potentially help them to persist in their academic endeavors. Results shows that 41 percent of the participant students have an internal motivation to know, another 46.3 percent of them have an extrinsic motivation to identify and 47.5 percent of the students show an extrinsic external regulation. 58 percent of them totally disagreed with amotivation, which reflects their understanding of the importance of schooling and STEM subjects in their education.

INTRODUCTION

The leading factor, motivation, seems to play a major role to inspire students to get involved with the course work (Yousefi Afrashteh et al. 2022). A comprehensive body of research, both in academic journals and mainstream magazines has been published on how the traditional methods of lecture are neither engaging nor robust enough for learners, particularly in STEM field (Cole 2022; Bartolini and Connor 2022; Lombardi et al. 2021; Tomas et al. 2019). One study indicates how college students in STEM classes with traditional lectures are 1.5 times more likely to fail than those in classes with active learning exercises (Shoufan 2020). In fact, the federal government's investment to improve STEM led to the development of special STEM high schools, who already realized their curricula needed to engage students front-and-center with real-world applications of STEM, rather than only focusing on traditional STEM course content and lectures (Papa and Jackson 2021; Granovskiy 2018).The traditional way of teaching using lectures and laboratories might work sometimes for a portion of students, but not all the students necessarily learn the same way. In the sciences, we seem to learn better by observation and imitation (Yu et al. 2018), for example, by doing a task or experiencing a situation. Nevertheless, a correct understanding of what and how motivation to learn actually works will allow us to make a better use of resources in a more meaningful and effective ways (Kraiger and Ford 2021). Current statistics of job satisfaction show how less than 50 percent of North Americans are dissatisfied with their jobs (Kelly 2019) and how increasing percentages of high school students are less interested in pursuing college education as time goes by, which could be greatly influenced by what they see at home. In October 2020, 62.7 percent of 2020 high school graduates ages 16 to 24 were enrolled in colleges or universities, down from 66.2 percent in the prior year, the U.S. (Bureau of Labor Statistics reported, April 2021).

Learning is natural to human nature (Stern 2017). There are many studies focused on understanding the mechanisms involved in human learning process (Bogaerts et al. 2022; Mancini et al. 2022; Rossi et al. 2021; Rodríguez et al. 2009), but the details of how exactly it happens are still not completely elucidated. What is clear instead, it is the fact that a motivated mind towards the learning process makes a substantial difference according to (Vallerand et al. 1992). In the process of understanding the mechanisms of motivation researchers have dissected it in three different basic parts: intrinsic, extrinsic and amotivational, which in turn have been subdivided in several subcategories as follow:

Objectives

This study has been conducted with the aim of gaining understanding on the effects of motivation on student's interest to go to college and get involved in STEM subjects and the specifics of the type of motivation in a cohort of 227 students from different levels of schooling

Intrinsic Motivation (Garay 2021)

It happens when there is a willingness to perform a particular activity that has been generated within the individual's internal though process as a consequence of an inward driving force, producing pleasure and satisfaction to who is pursuing such activity. Further studies deepened on this subject had proposed three clearly distinctive subcategories (Vallerand et al. 1989).

Intrinsic motivation to know: The driving force to know can be manifested in different forms, observation, exploration, curiosity just to mention few of them. In this subcategory, the intellect'slonging to learn fuels the learning process without any external push or calling for action.

Intrinsic motivation toward accomplishments: In this case, the motivation is driven more by the sake of reaching a giving goal. Oftentimes, it might present itself as an internal need to proof to oneself the ability to overcome obstacles. In this case, it is the goal itself the one fueling the process of learning.

Intrinsic Motivation to Experience Stimulation

This happens when the experience of learning generates pleasure and satisfaction from activities such as a class discussion, or a book reading or an inspiring lecture. Such experience is the ultimate cause for the individual's desire of learning.

In contrast to the internal motivation pathway, where the objective is to nourish and gratify the intellect throughout the learning process itself, there is an extrinsic avenue where motivation resides outside of the individual's mind represented as an external goal. It has been proposed by (Deci et al. 1985) that extrinsic motivation has three subdivisions: external regulation, introjected and identification.

In this case, the individual will be compelled to perform an action by pressure or reward mechanism, it is not a decision made from within but from outside conditions.

External Introjected

It happens when the individual gradually internalize external or past external experiences, which will be used to compel him/her to action, it is not generated from inside but from outside factors that gradually become internalized as time goes by.

External Identification

External and/or introjected regulations might seem genuinely generated within the individual's thought process and they even could be perceived as intrinsic motivation, but in actuality, these reasons have been picked up from the outside environment and the individual ended developing a close identification with those reasons.

Amotivation

When it comes to academic activities, there are individuals that simply find no reasons nor inside neither outside of themselves to engage in a given activity, they go through the moves of life without involvement at all, for them, it feels exactly the same whether they are or not part of the activity, It is perceived as if there was not a connection between one's actions and the consequences of such actions.

It is also pertinent to mention that STEM subjects as they have traditionally been taught, have left a sour taste on a vast percentage of students, impacting negatively their interest to explore these topics as possible professional careers (Patall et al. 2018). There is research in the area of cognitive psychology related to learning helplessness (Seligman1972), where the individual goes through a negative experience and reach to the conclusion that he/she will not be able to overcome that particular topic. Terms like mathphobia, first introduced by Mary Fides Gough in 1954 (Gough 1954), chemophobia (Laszlo 2006) have been coined as a result of widespread believe that these subjects are difficult, therefore a considerable percent of people have decided to believe that these are complicated subjects and if by chance we encounter these subjects, we should just suffer them and go through it hopefully as quick as possible. These wrong conclusions come fundamentally from early stages of schooling as methodologies (Johnson 2019) used to teach these subjects have not carefully consid-

ered or have failed to recognize early on, the multidimensional component of the learning dynamics in childhood (Astleitner 2018). These topics are explored in a paper currently in preparation by the same authors of the present paper.

Research Question and Related Hypotheses

Is it motivation really critical for students' success? The researchers primary interest is having an understanding of the reasons why majority of students are not attracted towards STEM subjects, and why is that a high percentage of the ones that finally have decided to take the chance, do not have an overall rewarding experience. Several separated studies coincide on the fact that motivation is a key factor for students' academic success. On the surface, motivation seems to be a specific ingredient in a cocktail of conditions needed to create a rewarding teaching-learning experience. Nevertheless, motivation itself can be dissected in smaller pieces that can hopefully help us to understand the real impact that motivation can have in the whole learning process.

METHODOLOGY

This study utilizes the Vallerand's AMS-U 28 form kindly authorized by Professor RJ Vallerand, it was applied to a 25 percent of the students surveyed, and a modified version of that form was crafted by the authors of this work, in order to establish the impact of motivation on its diverse forms on the students' interest to pursue STEM subjects as a possible pathway to continue their academic journey. By using evidence-base inquiry method (Abdi 2014), the researchers hypothesize that if somehow they can understand the distinctive forms of motivation and clearly distinguish their influence on students perception and learning goals, the researchers would have a desirable tool to tune lectures, labs, tutoring support in such a way that, it +could cover most of the students' expectations to make the academic experience truly transformational and perhaps raise the level of interest for the new generations of students to get more involved in science and technology with meaningful purposes.

Subjects

Both the AMS-U 28 form and its modified version were electronically distributed among the participating students by week 12 to 14. The formats utilized in the surveys are visual analog and likert scale close-ended type and the students were asked to fully answer all the questions presented to them. Data re-collected over a two academic periods from 2 of the 18 sections of an introductory-level chemistry course offered every semester by the Department of Chemistry at the Bronx Community College/CUNY. The course has a considerable percentage of math component, and it is required for students enrolled in STEM degree programs, and for a 12 years period shows a mean annual enrolment of 311 students according to a study of historical enrollment and course outcomes rates between spring 2005 and the summer 2017 (BCC Chemistry Department 2015), Fifty two students with a median age of 21 years of age, taking the introductory chemistry class at the time of this study at the Chemistry Department at the Bronx Community College, answered the original AMS-U 28 form. The modified version of the form was administered to at 7th and 8th graders from the Liceo Comercial Las Americas School in Bogota, Colombia with averages between 12 and 13 years of age all taken both math and sciences as part of their academic curriculum.

Instrument

The AMS-U 28 form given to students for this project contained 28 visual analog and likert scale close-ended type of questions to match up their feelings or opinions with either a positive or negative answers. The original AMS-U 28 questionnaire has also three well differentiated sections, which will allow us to identify the three types of motivation: intrinsic, extrinsic and amotivation; and their correspondent subcomponents. The conclusion derived from the collected data will definitively allow us to tune up both course methodology and delivery,in order to make it more meaningful and impactful on the students. The distribution of the questions is as follow:

1. Questions #: 2, 9, 16, 23 to evaluate intrinsic motivation - to know
2. Questions #: 6, 13, 20, 27 to evaluate intrinsic motivation - toward accomplishment
3. Questions #: 4, 11, 18, 25 to evaluate intrinsic motivation - to experience stimulation
4. Questions #: 3, 10, 17, 24 to evaluate extrinsic motivation - identified

5. Questions #: 7, 14, 21, 28 to evaluate extrinsic motivation - introjected
6. Questions #: 1, 8, 15, 22 to evaluate extrinsic motivation - external regulation
7. Questions #: 5, 12, 19, 26 to evaluate amotivation

The modified AMS-U 28 form for this study, was customized with the purpose of finding out the motivation towards STEM subjects; it contains 14 questions with the same category distribution as shown above and 6 additional questions including various correlated aspects such as, access to internet and computers, parents and other family members supporting their learning process, which also can help emotionally to maintain the interest and strengthen the process of learning.

Procedure

The study began by sending the digital forms utilizing Google forms format to the participating students, they had the option to answers the questions on their own time. The form remained active for a couple of weeks so, they could have plenty of time to accommodate their schedule accordingly in order to make time to answer the proposed questions. The answers were all collected in a data base to later be processed, assessed and interpreted.

RESULTS

Data Processing

The information collected from the participating students have been processed by JGO Scientific Learning team, a tech company supporting this study, utilizing the answers from the Vallerand's modified test, which was applied to 175 of the 227 total participating students based on age and gender, in order to have a more comprehensive image of how motivation is perceived in different students' age/groups. Table 1 shows the data collected.

From the surveyed cohort of participating students, majority of answers were collected from individuals fluctuating between 12 to 13 years of age. The questions included in the modified version, were structured following the Likert scales type of questions, where the student have the option to select a suitable answer from a range of choices. The final version of the questionnaire is presented in the Table 2.

Table 2: AMS-U 28 modified version, to target student's interest in STEM subjects.

Item	*Questions*
1	I'm going to need it to do well next academic year.
2	Because I feel pleasure and satisfaction when I learn new things.
3	Math and science will help me to be better prepared for the next level.
4	I like to communicate my ideas to others.
5	I honestly don't know, I think math and science are a waste of time.
6	Improving myself makes me feel good.
7	I want to see if I am able to pass these classes.
8	I need to be well prepared for the coming year.
9	I enjoy discovering things I didn't know.
10	It will help me understand these subjects better when I move on to the next course.
11	I like to read my math and science books.
12	I used to like math and science, but now I'm doubting it.
13	I feel happy when I exceed my goals.
14	When I do well in these courses I feel important.

The statistical treatment of the data collected has included the analysis of the internal consistency of the data obtained from the survey, showing a Cronbach's alpha coefficient of 0.7. This value certainly confirms that the collected information is consistent and it has permitted us to apply a multifactorial analysis of the data as (Nunez 2006) suggested in his paper.

Table 3, shows the descriptive analysis includes parameters such as, the mean, the typical error, the

Table 1: Distribution of the cohort of participating students classified by age and gender

Age	*10*		*11*		*12*		*13*		*14*		*15*		*Total*	
Gender	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Female	4	2.3	18	10.3	29	16.6	30	17.1	5	2.9	1	0.6	87	49.7
Male	2	1.1	15	8.6	30	17.1	30	17.1	9	5.1	2	1.1	88	50.3
Total	6	3.4	33	18.9	59	33.7	60	34.3	14	8.0	3	1.7	175	100

Table 3: Descriptive analysis includes parameters such as, the mean, the typical error, the mode, the standard deviation, the variance, the kurtosis and the asymmetry coefficient analysis

Items	*EM Ext. Regult.*		*IM to Know*		*EM Identified*		*EM to exp. Stimulation*		*Amotivation*		*IM towards Accomplish.*		*EM Introjected*	
	1	8	2	9	3	10	4	11	5	12	6	13	7	14
Mean	6.01	6.43	5.71	6.23	6.27	6.38	4.73	4.34	2.18	3.50	6.17	6.65	6.18	5.70
Typical Err.	0.09	0.08	0.09	0.07	0.08	0.06	0.11	0.12	0.13	0.15	0.08	0.08	0.09	0.09
Mode	7.00	7.00	6.00	7.00	7.00	7.00	5.00	5.00	1.00	1.00	7.00	7.00	7.00	7.00
SD	1.8	1.01	1.24	0.93	1.01	0.85	1.51	1.63	1.67	2.02	1.11	0.74	1.15	1.25
Variance	1.39	1.02	1.53	0.86	1.03	0.72	2.27	2.65	2.78	4.09	1.24	0.54	1.33	1.57
Kurtosis	3.10	7.06	1.69	0.66	6.43	1.06	-0.18	-0.34	0.82	-1.18	4.18	5.46	5.30	0.53
Asymmetry	-1.53	-2.37	-1.21	-1.14	-2.08	-1.34	-0.36	-0.36	1.36	0.20	-1.74	-2.32	-2.06	-0.85

mode, the standard deviation, the variance, the kurtosis and the asymmetry coefficient analysis. All these results together suggest that the factorial analysis will render high quality results.

The correlation between questions 1 and 8, which belongs to the extrinsic category, shows a 0.44 index. Questions 2 and 9, which are part of IE to know, the result is above 0.48, which happens to be the same correlation between items 3 and 10. Questions 5 and 12 measuring amotivation provide a correlation above 0.5. For intrinsic motivation to achievement the correlation reaches 3.9.Items 7 and 9, where the correlation reaches 0.43, measure the correlation between extrinsic motivation and introjected motivation. These data provide us with statistical consistency to generate subsequent analyses.

After performing the general analysis of the data gathered with the application of the test, a Chi-square of 749.414 was obtained, with 91 in the degrees of freedom and a p value of 0.001, using the maximum likelihood extraction method (Cox et al. 1996) to generate a rotation with six iterations which provides us with 3 general analysis factors summarized in Table 4.

Table 4: Maximum likelihood extraction method to generate a rotation with six iterations which provides us with 3 general analysis factors

Item #	*Factor*		
	1	*2*	*3*
Item 10	0.716		
Item 7	0.686		
Item 13	0.578		
Item 14	0.574		
Item 6	0.554		
Item 9	0.522		
Item 3	0.515		
Item 8	0.510		
Item 1	0.427		
Item 5		0.705	
Item 12		0.682	
Item 11			0.726
Item 4			0.628
Item 2		0.314	0.439

It is important to consider factors 2 and 3, because they show a statistically significant correlation between items 5 and 12 and items 4 and 11, respectively. This statistical relationship generates a direct correlation with the relevant aspects in the adjusted Vallerand test, since items 5 and 12 corre-

spond to the amotivation factor and items 4 and 11 to the intrinsic motivation factor, which is related to experience stimulation.

In order to facilitate the statistical analysis and interpretation of the results, data was split into seven categories summarized in Table 5.

Table 5: Correlation between the question number and subcategories of motivation

Items	*Type of motivation*
2, 9	Intrinsic motivation - to know
6, 13	Intrinsic motivation - toward accomplishment
4, 11	Intrinsic motivation - to experience stimulation
3, 10	Extrinsic motivation - identified
7, 14	Extrinsic motivation - introjected
1, 8	Extrinsic motivation - external regulation
5, 12	Amotivation

This partial analysis summarizes the general tendencies of each of the groups is shown in Figure 1

According to the scale presented in the Vallerand's test, the likert scale goes from ONE which indicates that the stated statement does not correspond at all to the surveyee's thinking, while SEVEN means that the statement corresponds exactly with the surveyee's mind. With this scale in mind, 2.48 is the lowest value which correspond to amotivation, while 6.41 is the highest corresponding to intrinsic motivation.

One important factor to address is the one related to home support with homework in STEM related subjects. The answers to this question varies between 8 percent in the worst case scenario and 27 percent at the best, this indicates that parents, or family members has plenty of room to grow and become more relevant, it can has the potential to significantly help student to perform better and overcome obstacles more effectively.

DISCUSSION

This study did start with the assumption that motivation is a key aspect for students' academic success, but the first requirement for students to be successful, is to make sure that they remain in school. Covid 19 has changed dramatically the way how schooling used to be (Devlin 2022). Before pandemic, in-person instruction was the dominant model of instruction, and instructors used to have more influence on students' involvement in aca-

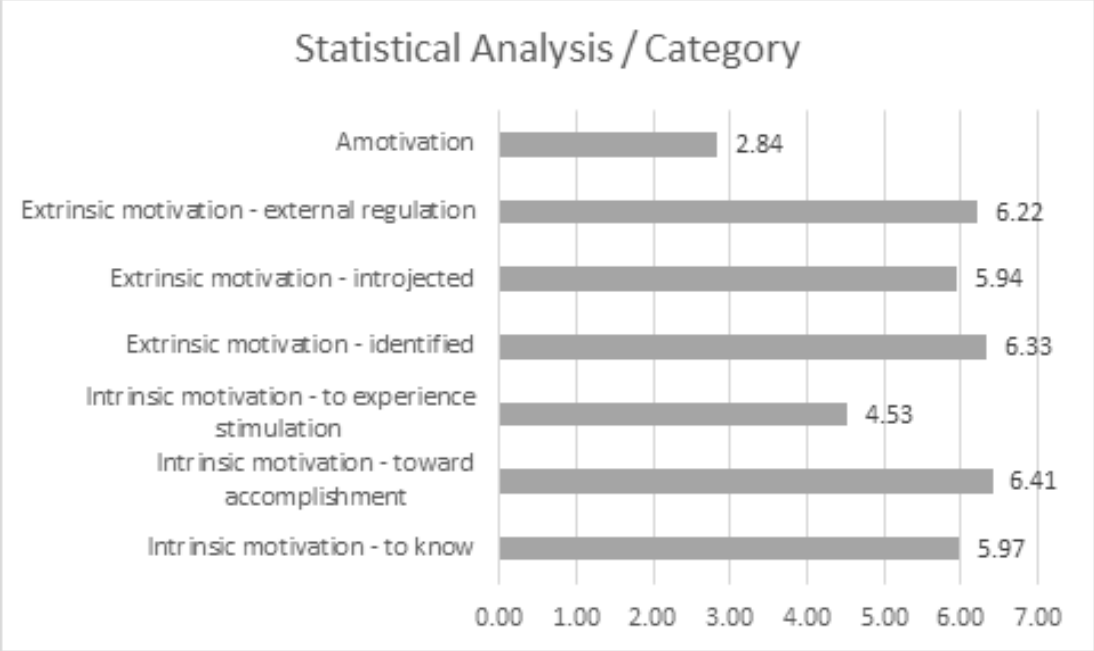

Fig. 1. Results of statistical analysis by categories of motivation

demic activities. Suddenly, covid-19 forced to change from *in-person* to online instruction, where the presence of the instructor was only limited to the length of the lecture when synchronous mode was in place. As a result of these changes, asynchronous lectures became more popular where the interaction with the instructor was reduced even further down. These changes somehow forced students to become more autonomous in making their own decisions about when and how to address their involvement with academic work, in a short period of time, they discovered opportunities to combine more extracurricular activities with their full time student commitment, and at the same time, forcing institutions to redirect their efforts and resources to satisfy the newly created demands. In this new context, motivation to remain in school has become in a more complex matter. Institutions not only need to make sure they comply with all official requirements to guarantee their academic standards, but also they are under the pressure to create more appropriate conduits to capture students interest and needs and figure out strategies to keep them engaged. With this consideration in mind, the first part of this study utilized Vallerand's test to glance the type of motivation that college students have to continue their academic careers. The results show that the highest motivation factor, 56.70 percent to go to college is extrinsic specifically external regulated motivation, which means that students will go to college whether for pressure or reward type of reasons. The pressure could be related to social conditions, market demands, peer pressure, social standing pressure or perhaps attracted by the benefits that a college education supposed to represent, but oftentimes distorted by unrealistic or misleading expectations, In this case, motivation can become easily in an unfulfilled expectation, which will drag them out, as academic demands start to tighten up and the weakness of the students-college bounding not solidly cemented enough to keep them around. The second highest motivation percentage, 52.50 percent is also extrinsic towards identification. In this case the student has identified him or herself with external role models or ideas about college education. Oftentimes, there is not a judiciously crafted process of career selection backing up the student application to college, so this unchallenged ideas about college education might result in a fantasized or chimeric construct with very weak foundation to maintain them engaged for the long run. The third highest percentage of motivation to go to college, 47.30 percent is also extrinsic towards introjection, which means that reasons seems internal but in reality all them are picked from the outside collective imaginary, these results put colleges in a compromised situation, as the incoming students will be going to school looking for stereotypical benefits such as monetary improvement, social recognition, career promising future, which often times might not necessarily be matched up by the reality. In such conditions, the relationship student-college becomes brittle and fragile, as the main attractive force that drove them to college was way too shallow. From these results is clear the need for colleges to bring to the table a much stronger academic proposal in order to guarantee a harmonious overlapping between students' motivations and the realistic capabilities to deliver the promised benefits and hopefully exciding their expectations. Fortunately, the fourth highest motivation, 45.10 percent is intrinsic motivation to know, this means that students are genuinely internally motivated to search for knowledge, and because it is an internal driving force originated from within themselves, it can be self-sustained and potentially capable to inspire the student to continue his/her academic endeavors more consistently. In fact, 57.0 percent of the surveyee's opinions agreed that amotivation, which is the absence of reasons to go through college, is not an option for them.

These results are critical as it was mentioned at the beginning of this section. The success of any student in college is first and foremost to make sure that he/she remains registered and active in his/her academic life, as long as that component is there, we will have opportunities and hope to develop tools to maintain and raise their involvement with their academic career.

The first requirement in searching for students' academic success must be to ensure that the students will be willing to continue attending school, once attendance is satisfied, then we can focus our attention on the STEM subjects, and the reason why they have decided to choose this important field of study. Technology and sciences are paramount to modern society and attracting students to this area is essential to remain highly competitive in modern world. The data shows that 61 percent of students have an intrinsic motivation towards accomplishment, which means that stu-

dents are expecting to satisfy specific goals that they have envisioned. These goals could even be just to proof to themselves that they can overcome the challenge or learning these subjects. Sadly enough, there are large percentages of students who have developed learning helplessness acquired at early stages of exposure to STEM subjects. This conditioning to failure has prevented students to open themselves to new opportunities to learn these kind of subjects, as the negative experiences override any new attempt to approach these topics with a fresh perspective. This is the reason why motivation can spark the interest to learn, but the subsequent phases must require to introduce appropriate teaching methods capable to harness the fuel produced by motivation, which by itself, will not be able to sustain the interest in the long run. Not in vain, the second larger percentage of motivation is extrinsic toward regulation, 47.5 percent which indicates that the external pressure or reward is igniting the interest for STEM sciences. It is obvious to see how the multiple benefits that modern society enjoys today are related to applications of STEM subjects to make life easier and more efficient, nevertheless, what is not that obvious is to see the existing correlation of principles learned from STEM in the class rooms with the gadgets and conveniences that we all enjoy nowadays. The 47.5 percent represented in external regulation then must be perceived as a pressure or reward instead of internal desire to accomplishment. The third higher percentage of motivation towards STEM is identification, which reflects the interest of the individual to solve or understand external issues perceived as if they were generated from within, but in actuality, they are coming from outside stimuli, this is a good indication of the need to properly comprehend the concepts from their applicability rather than the purely conceptual frame. In contrast, 41 percent of the motivation is towards intrinsic interest to know, which reflects that not only the application is important, but the understanding of the theoretical part alongside is desirable for a sizable segment of students. This apparent contradiction shows the need to address STEM instruction from both perspectives, concept/application which make an ideal combination to maintain the motivation and interest in continuing their professional development in these areas.

In both cases, amotivation shows the highest percentages of disagreement, which means that most of the students do not want to go to classrooms just for the sake of showing up, but because they find somehow a beneficial effect from both going to school and be invested in studying STEM subjects. Another interesting finding from the data collected, is that in any case, the surveyed students derived pleasure from going to school or studying STEM subjects, which should make us to consider if both school and STEM are being correctly presented. If people can't be happy with what they do, chances are that the interest and motivation to work on those activities should not necessarily be at its highest either, so they will simply join these disciplines for external motives, as the numbers effectively demonstrate. Perhaps that is the reason why in North America for example more than 50 percent of the surveyed people are unhappy with their jobs, and people are waiting for Friday as the opportunity to escape from what is perceived as a burden. It seems that both age and gender are not big differentiators as the data collected shows.So we can infer that this is more a social construct that an individual issue, which is actually a positive aspect, as it eliminates the need to emphasize our differences, based on gender or age.

Motivation can effectively move people to action and somehow inspire them, but it must be only considered as the spark that turns the fire on, consequently, additional steps must be properly laid out on the way, to continue feeding the interest and perseverance to accomplish the final goals.

CONCLUSION

The data collected from this study shows that motivation is effectively an important component to be considered, as motivation provides the momentum necessary to overcome the inertia that could hold the individual off, nevertheless, it cannot be considered as the only factor responsible to maintain students motivated throughout the whole academic lifespan. There are many more aspects to be taking into account to draw people towards school and specifically to choose STEM areas. The data shows that majority of students have extrinsic motivation to both join college and study STEM, whether through regulation, introjected or identification, which indicates that the environment both social and physical drives the academic preferences, it is also clear that instruction methods where application of theoretical princi-

ples are clearly translated into technological applications, will allow students to see the correlation and understand better the connections rather than simply memorize massive amounts of information without being confronted against the individual's own experience. It opens the door to explore experiential learning methods to favor the comprehension of natural phenomena.

Dissecting motivation in its different components has also permitted us to correlate the high index of job dissatisfaction, as the data shows how majority of the surveyed students have placed their motivation on external factors, specially external regulated, or identified, which annihilate the individual's truly innate interests and abilities to only dedicate their time to blossom in such area of interest. No amount of external motivation will ever be able to overpower the internal self-drive to accomplish what truly exist in an individual's deepest nature.

No significant differences in the results associated to gender, age or schooling level were observed, which means that it is more a social construct rather than an isolated academic issue.

RECOMMENDATIONS

This was a preliminary study to learn about what really motivates students to overcome all kind of difficulties to reach their academic goals, and because this is a multifactorial topic, it will require the participation of colleagues from different disciplines to fully address all the complexities in order to support students more effectively in their quest to get educated.

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FUTURE STUDIES

More studies related to STEM, gender, age and schooling level must be done to confirm these preliminary findings in order to draw meaningful conclusions and suggestions applicable to different levels such as administrators, teachers, and government agencies to make decisions about adopting academic reforms as part of students' academic resources to motivate and improve student retention, registration and academic success which is the shared objective of school administrators, government agencies.

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