



Treball Final de Grau

Teaching Chemistry to students with special educational needs. A viability study of adaptations proposed to improve the current inclusion program for SEN students in the Faculty of Chemistry.

Ensenyament de la Química a alumnes NEE. Estudi de viabilitat de les adaptacions proposades per millorar l'actual programa d'inclusió pels alumnes amb NEE de la Facultat de Química.

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La discapacitat no et defineix; et defineix com fas front als desafiaments que la discapacitat presenta.

Jim Abbott

En primer lloc, m'agradaria transmetre el meu agraïment a la meva tutora, la Rosa, per acompanyar-me durant tot aquest viatge. Per la comunicació constant, per tot el temps dedicat i per la gran feina que fa en el camí cap a la inclusió. Gràcies per vetllar cap a la igualtat d'oportunitats.

Tanmateix, voldria manifestar el meu més sincer agraïment a la bona predisposició de tots els alumnes i professors enquestats, sense els quals no hagués estat possible extreure les conclusions de l'estudi i poder aportar el meu granet de sorra.

No voldria deixar d'agrair també a tot el meu entorn proper, a la família, parella i amics, pel suport durant tot el grau i en especial en aquesta recta final.

A tots ells, gràcies.

REPORT

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1. SUMMARY

In an increasingly diverse society, equal opportunities are the order of the day. Moreover, our university model must be adapted to the international convention on the rights of persons with disabilities, signed by our country and, therefore, converted into law. Consequently, denying “reasonable” adaptations in university education would constitute discrimination on the basis of disability and would violate the law.

This work aims to propose adaptations to improve the inclusion of students with learning difficulties at university, and more specifically, it studies the feasibility of these adaptations to be applied in the Faculty of Chemistry of the University of Barcelona.

The necessity of adapting university studies without altering their content requires an exhaustive analysis of all adaptations presented in previous studies. This study explores the possibility of applying these adaptations from the non-alteration of the academic level to the opinion of the teachers, focusing on the needs of the students involved through a direct relationship with them. Based on the results obtained, the intention is to improve the current Inclusion Program of the Faculty of Chemistry of the UB, as well as to establish a starting point to continue in the study and constant transformation that defends the right of everyone, who is capable enough, to be able to obtain a university degree.

Keywords: university inclusion, special educational needs, adaptations for inclusion, learning difficulties, viability, Inclusion Program.

2. RESUM

En una societat cada cop més diversa està a l'ordre del dia vetllar per la igualtat d'oportunitats. A més, el nostre model universitari s'ha d'adaptar al conveni internacional sobre els drets per persones amb discapacitat, signat pel nostre país i, per tant, convertit en llei. En conseqüència, si es deneguessin adaptacions "raonables" en l'ensenyament universitari s'estaria cometent una discriminació per raons de discapacitat i es vulneraria la llei.

Aquest treball té com a objectiu proposar adaptacions que millorin la inclusió dels alumnes amb dificultats d'aprenentatge a l'etapa universitària, i més concretament, estudia la viabilitat d'aquestes adaptacions per aplicar-les a la Facultat de Química de la Universitat de Barcelona.

La necessitat d'adaptar uns estudis universitaris sense alterar-ne els continguts passa per analitzar profundament totes les adaptacions presentades en estudis previs. En aquest treball s'estudia la possibilitat d'aplicar aquestes adaptacions des de la no alteració del nivell acadèmic fins a la opinió del professorat, focalitzant-se en les necessitats dels alumnes implicats mitjançant una relació directa amb aquests. A partir dels resultats obtinguts es pretén millorar l'actual Programa d'Inclusió de la Facultat de Química de la UB, així com establir un punt de partida per continuar en l'estudi i transformació constant que defensi el dret de tothom, suficientment capacitats, per poder obtenir un grau universitari.

Paraules clau: inclusió universitària, necessitats educatives especials, adaptacions per a la inclusió, dificultat d'aprenentatge, viabilitat, Programa d'Inclusió.

3. INTRODUCTION

With the intention of going on towards equal opportunities in daily life in today's society, and with the conviction that all human beings should be able to achieve our dreams regardless of our condition, this work aims to serve as help for all those students who wish to obtain a university degree without worrying about their difficulties.

It is specifically aimed at students with specific educational needs (SEN) such as autism spectrum disorder (ASD), Asperger's syndrome, specific learning disorder such as dyslexia, schizophrenia spectrum, anxiety disorders... among many others.

In particular, this study will analyse the feasibility of applying the inclusion measures adopted in universities in other countries, which have been compared in a previous work¹ with those applied in the Faculty of Chemistry of UB. To this end, both teaching staff and students will be consulted in order to decide on the best possible adaptations for SEN people, without affecting the concepts that must be acquired in order to pass the subject.

Once the preliminary study has been carried out, an adaptation model will be developed for a subject from the teaching plan of the Chemistry degree of UB, applying the measures and changes that have been deemed appropriate.

First of all, we will briefly summarize the work carried out previously in order to find out what adaptations are carried out in other universities, as well as which ones are carried out in the Faculty of Chemistry of the UB and which ones are not.

3.1. FACULTY OF CHEMISTRY OF THE UB CONDUCT IN FRONT OF SEN STUDENTS

In order to accomplish this work, it is important to have some previous concepts about the protocol that is carried out in the Faculty of Chemistry of the UB with SEN students, which can be found in detail in the Appendix 1 of this report. It is also necessary to know what type of difficulties are the most common and treated to date in order to study and decide on the best

adaptations to carry out. This information will be briefly presented, as it is detailed in depth in Judit Carreras' final degree project¹.

3.1.1. Inclusion program of the Chemistry Faculty of the UB

The UB's Faculty of Chemistry has an inclusion program that aims to monitor SEN students in order to adapt their learnings and assessment models according to their needs, without disrupting the content to be acquired or the skills to be developed in each subject.

It is currently a highly personalised program that studies each individual case, working between the student, the inclusion tutor and the teachers.

The intention is that the inclusion program will grow and there will be established adaptations that facilitate the process of helping the student through resources known for students and teachers.

The method of operation of this inclusion program can be found in Appendix 1.

3.1.2. Most common types of SEN students in the Faculty of Chemistry of the UB

It is considered that a student has specific educational needs (SEN) when he or she requires, during a period of schooling or throughout it, specific educational support and attention due to physical, mental, cognitive or sensory disabilities. This is a very large community, of which we will focus on the most frequent disorders to date at the Faculty of Chemistry of the UB. These are explained in the first reference of this work¹.

The disorders we will consider are the following ones:

- Autism spectrum disorder (ASD), especially Asperger's syndrome.
- Attention deficit hyperactivity disorder (ADHD).
- Specific learning disorder, including dyslexia and dyscalculia.
- Bipolar disorder.
- Depressive disorders.
- Anxiety disorders.
- Obsessive-compulsive disorder.
- Personality disorders.

3.2. POSSIBLE MEASURES AND ADAPTATIONS

Improving and adapting the day-to-day life of SEN people is not easy and requires a lot of effort from everyone involved. That is why, with the intention of facilitating their possible full integration in the Faculty of Chemistry of the UB, the work prior¹ to this has been based on searching and comparing the methods of inclusion of different European, Anglo-Saxon and American universities. Based on this research, we will study the main adaptations that are made, with the intention of applying those that we consider most appropriate in the inclusion plan of this faculty.

3.2.1. Summary of studied measures

Below there is a summary table of all the adaptations that are applied, marking with an 'X' the university centres in which each of them is adopted. The adaptations have been separated into those carried out during exams and those which are applied during the course for a better understanding and differentiation.

- Exam accommodations:

Accommodation	Milan	Gottingen	Stockholm	Manchester	Bristol	Washington	UB
Extra time	X	X	X	X	X		X
Alternative format	X	X	X	X	X		X
Different exam			X				
Adapted exam				X			X
Split the exam into two or more parts	X						X
Relaxing breaks		X		X	X		X
Toilet breaks				X			
Separate room		X	X		X	X	

Use of a concept maps or forms	X						
Use of computer or digital tools	X		X		X		
Reading teacher or assistant during the exam	X	X		X	X		
Special attention from the person supervising the exam				X	X		X
Use of cancelling headsets						X	

Table 1. Comparative table of examination accommodations for SEN students in different universities.

○ Adaptations during the course:

Accommodation	Milan	Gottingen	Stockholm	Manchester	Bristol	Washington	UB
Reference teacher or Inclusion tutor	X	X	X	X	X	X	X
Support program				X			X
Toilet breaks				X			
Use of computer or digital tools	X		X	X			
Study tutor or assistant	X	X	X	X	X		
Note-taking support			X	X			

More time for book loans	X						
Course material in alternative form			X	X	X		
Adaptation on internships		X		X	X		X
Adaptation of assessment when attendance is obligatory		X		X		X	X
Flexibility on deadlines	X			X			X
Relaxing rooms			X				
Awareness of the student's condition				X			X
Provide a technical glossary				X			
Changes in group works				X	X		X
Alternatives for oral presentations				X			X
Audio recording lessons						X	

Priority registration						X	
Reduced credit load						X	X

Table 2. Comparative table about course accommodations for SEN students in different universities.

4. OBJECTIVES

The main objective of this work is to study, analyse and determine the adaptations, methods and aids that could improve the current inclusion program of the Faculty of Chemistry of the UB so that students with specific educational (SEN) can follow the degree with less difficulty.

Consequently, with the aim of achieving suitable adaptations, both in terms of help and that they should not affect the knowledge that must be acquired to pass the subjects, the aim is to reach a consensus with both teachers and SEN students to decide which ones will be put on practice.

Once the measures have been decided, the intention is to present a possible adaptation of those that have been determined for a subject of the degree, so that it could serve as a model to facilitate the inclusion of students with difficulties. It is intended to be the continuity and enhancement of the process of inclusion and support for SEN students, which should be developed in the near future. In other words, we want to set up a protocol based on certain adaptations so that the degree can be completed with no additional difficulties to those inherent to the degree itself. In addition, it is worth mentioning that this protocol must be continuously revised so that the current model of university teaching tends towards a universal learning design.

5. METHODS

This work will be carried out based mainly on the previous study above mentioned¹, from which the results of the comparative analysis will be extracted. The comparative study will be continued in order to draw conclusions with the intention of expanding and improving the adaptations that the Faculty of Chemistry of the UB can offer.

Therefore, the study will be organized into three distinct parts:

- Preliminary study based on the analysis of the information and conclusions drawn from the previous work¹. A pre-selection will be made of the methods and proposals considered most feasible to apply, both by teachers and students. The aspects taken into account to study them and determine the most suitable ones are the following ones:
 - The feasibility according to the teaching and evaluation methodology, depending on the teaching plans.
 - Acceptance of the adaptations by the students to ensure their full confidentiality.
- To make a proposal that combines the two previous points. To this end, surveys will be carried out with both teachers and SEN students proposing the measures decided on previously, as well as asking teachers for new ideas. It will be concluded which ones are suitable for implementation.

The surveys will be different for teachers and students.

Everyone's anonymity will be respected, being the inclusion tutor who distributes the surveys, and at the same time they can be completed without having to identify oneself.

- Application of these adaptations to a subject of the Chemistry's degree of the UB. This subject will be decided according to the level of difficulty of concepts, the academic material provided during the course and according to the consideration of the inclusion tutor of the faculty, who is also the tutor of this work, and myself as a recent student of the degree.

6. STUDY AND DETERMINATION OF FEASIBLE ADAPTATIONS

6.1. PRE-SELECTION OF PROPOSALS AND POSSIBLE ADAPTATIONS

In order to make a first pre-selection of the most viable adaptations to facilitate the inclusion of students with difficulties, we will use the tables shown in section 3.2.1., the intention of which is to combine all the measures applied in other universities into two single tables. In this way, we can see more visually which measures are the most used and which are not yet used in the Faculty of Chemistry of the UB, with the intention of carrying out a preliminary study about each one and their feasibility of application.

Moreover, it has been considered convenient to separate the adaptations according to whether they are made in exams or during the teaching of the subject. This is because some of them are specific to facilitate the concentration and the understanding during the exam, while others serve to simplify the acquisition of the concepts of the subject or to make easier their study.

The main objective of education for students is to learn, assimilate and understand the content they are being provide with. It is true that a large part of the measures to improve the inclusion of people with disabilities are aimed at the learning process, which are intended to facilitate and improve the acquisition of concepts for students. But in the end, the only way for them to demonstrate what they have learned during the course is through an assessment, and therefore it is just as important to adapt the learning process as the assessment. For this reason, we believe that students must know how to take examinations and for that it is essential that they will be provided with adapted forms to enable them to do so. Therefore, we will separate the adaptations that take place in examinations and during the teaching process.

To sum up, the tables mentioned above will be analysed below in order to define the pre-selection, which will then be compared with the results obtained in the subsequent study. For this, we will follow the criteria explained in the method in the previous section.

6.1.1. Pre-selection of exams adaptations

As stated before, the only way to know if the knowledge of a subject has been acquired is through assessment. That is, the way to demonstrate learning is based on a direct relationship between concepts and test. On the other hand, this obviously does not mean that there should

be a single exam that defines the level of assimilation by means of a single numerical value, be it the mark obtained in a written exam.

For this reason, the UB's Faculty of Chemistry of the UB uses a methodology based on continuous evaluation by means of various tests during the course, assignments, works or direct communication between students and teachers by mail, for example. This method benefits all pupils in general, but especially those with disabilities. Consequently, these assessment measures need to be worked on and improved in order to achieve the inclusion of SEN students because these are exactly what they need in order to feel comfortable and reassured during an assessment.

Even so, we must keep in mind that we are in a public university, where there are a large number of students and therefore some of the possible adaptations are less feasible than others. Consequently, we will analyse and propose the methods that we consider the most viable to implement.

Table 1 in section 3.2.1. shows that the Faculty of Chemistry of the UB takes quite a number of support measures for SEN students during exams. For this reason, we will begin by analysing those that can improve the current ones:

- Taking a different test → Taking a different test from the rest of the class will never be a fair adaptation, as no two exams will never be the same difficulty, no matter how hard you try it. Therefore, we do not consider this adaptation to be appropriate.
- Separate room → This measure is one of the most used in the rest of universities. We consider it to be a good method for the student to be concentrated and calm before the exam. In order to carry out this measure, the student's acceptance must always be taken into account. Also, extra teachers will be needed to monitor the separate room.
- Use a concept map, forms or digital tools → We consider it is not a possible adaptation, because the inclusion program insists that the changes made to the academic curriculum, the use of alternative methodologies and the additional resources provided, should in no way alter the minimum knowledge to be acquired or the specific competences to be developed for each degree. While providing them with this extra material in exams could result in them not acquiring all the knowledge that is considered essential to understand the subject.

- Reading teacher or assistant during the exam → If this method is carried out in front of all classmates, it can lead to a situation of differentiation that is uncomfortable for the pupil. On the other hand, if it is done in a separate room, it can be very favourable for the pupil. Also, instead of being administered in separate classrooms, it can be administered prior to the exam. That is, the student meets the teacher to read the exam before it starts so that the professor can make sure that the student has understood it, or can help the student to understand it if he has not. This method has been used in UB's Faculty of Chemistry before, and has produced very good results. We believe it can be a good method to continue to apply and improve.
- Use of cancelling headsets → This way of helping the student can be very favourable for his or her concentration during the exam, and also does not create an uncomfortable situation for him. However, it should be noted that the teacher should be warned if the student uses them, so that if the teacher makes any general comment about the test, the student will be warned beforehand.

To sum up, all those measures that are not implemented and which we consider appropriate, should be added to the existing ones. While those that are currently carried out should be worked on in order to improve them and be able to establish a plan for inclusion for the exams.

The set of exam adaptations that we consider to be feasible and an improvement on the current one is:

- 1) **Have extra time.**
- 2) **Split the exam into two or most parts.**
- 3) **Relaxing times.**
- 4) **Reading teacher or assistant during the exam.**
- 5) **Make the exam in a separate room.**
- 6) **Use cancelling headsets.**

These adaptations can be used to help all SEN students, although they may benefit more or less depending on their disability. In the same way, we also consider that these adaptations should complement each other, and should be adapted to the type of exam being taken, always in mutual agreement with the student. For example, if it is a short assessment exam, perhaps it

is not necessary to split exam, but it is necessary to do it in a separate room or to use cancelling headsets.

Taking into account the introduction of this subsection (6.1.1.), we consider that this set of measures is a good option to improve the inclusion in assessment. Because although the main objective is to learn, it is equally important for the student to be able to demonstrate his learning without having additional difficulties to those of the subject itself, such as being overwhelmed or lack concentration in front of other people or large spaces.

To conclude, we would like to quote how Laura Sokal and Laurie Anne Vermette's define test accommodations in their study² for the magazine 'Journal of Postsecondary Education and Disability':

"Test accommodations are defined as altering the processes of test administration in such a way that the test can accurately measure how well the student has learned the materials taught without altering or 'watering down' the construct being tested. Their goal is to 'level the playing field' so that the learning (knowledge, skills and abilities) of students with disabilities can be accurately measured".

6.1.2. Pre-selection of course adaptations

Once we have proposed the methods that we consider to be the most effective for exams, we will proceed to study those that are applied during the course. These are very important because they are an aid for students' day-to-day work, which are decisive for their understanding and assimilation of contents.

In order to propose the most viable measures to carry out, with the aim of improving the current ones and offering new possibilities, we will use as a reference the UNIDISCAT project³ (Universitat i Discapacitat a Catalunya). This is based on the need to respond to the challenge of achieving a fully inclusive university and which was developed by the Consell Interuniversitari de Catalunya (CIC). All Catalan universities are represented in this project and it aims to unify programs and services that are carried out to achieve the greatest possible inclusion of people with disabilities.

Our aim is to be able to come up with a set of measures for SEN students in order to improve the inclusion plan and to help the inclusion tutor, pupils and teachers in front a situation that requires their application.

Consequently, we proceed to analyse both the measures that are already in place and those that are not, in order to propose the set of feasible measures to be carried out during the learning process. Again, we will use the tables in section 3.2.1., specifically table number 2.

Support program → This measure already exists in the Faculty of Chemistry of the UB. We believe that it is very important for students to have support available to them, so it should be maintained and we should try to improve it.

Inclusion tutor → It is essential to have an inclusion tutor who follows the evolution and is in contact with the pupil. His role should be accompanied by coherent and verified adaptations within the legal and curricular framework of the degree. These can be proposed and implemented together with teachers, but always with the consent of the student.

Awareness of students condition → This measure is also implemented, and we believe it is absolutely essential. We think that it is crucial for inclusion that teachers know that they have students with special needs, as well as knowing who they are so that they can give them the attention they need. This measure is one of the main functions of the support program and the inclusion tutor, presented above.

Study tutor or assistant → Having a helper, whether a teacher or another learner, can be very rewarding for the student. This can help SEN students to check what they have understood in class or to clarify those aspects they have not quite grasped. As teachers are aware of their difficulties, they can encourage them to raise further questions or doubts they may have, to get them more involved in class or, if they prefer, to raise them during tutorials.

In this way, teachers can see how far they have comprehended and can help them to keep track of the homework they have to submit or to recommend how to distribute the syllabus for study. This is a good way to facilitate and control students' learning. For example, for those with ADHD, because as Juan Antonio Amador (lecturer at the Faculty of Psychology of the UB) explains in his speech⁴ at one of the workshops held by UNIDISCAT, organizing their work, being productive and maintaining their attention are some of the greatest difficulties for them.

Note-taking support, course material in alternative form and computer or digital tools → Any way of providing additional subject material, so that students with difficulties can have an easier time understanding and comprehending the subject, is beneficial to their inclusion in the learning of the subject. There are several ways of doing this, but basically, they all aim to explain the same concepts that have been taught in class but in a different way.

Even so, it is very important that this additional material will be provided to all pupils, because in no case SEN students should have more benefits than the others because of having difficulties. Just that they will be able to make use of this extra material to complete their comprehension and others may not need it.

For example, providing a summary or an outline of the syllabus before explaining it in class can help the student to be situated and better able to follow the lesson. On the other hand, instead of providing material before class, notes, summaries or technical glossaries of the session could be provided at the end. Also, videos can be recommended or given in order to help to understand the concepts of the subject, as well as providing material adapted taking advantage of new technologies, which will be more visible.

Flexibility on deadlines and on assessment when attendance is mandatory → These measures are already in place at the UB's Faculty of Chemistry, but they should be applied in cases that really need it.

The first measure is requested by a large number of students, but in many cases, it is not necessary to apply it because the problem is not the delivery time. For this reason, once again, it is very important the role of the inclusion tutor, who should study each case and decide whether it will really help the student to have more time or not.

In the second case, more students may need this measure, since many of the educational disabilities cause stress and overwhelm and in many occasions result in the pupil not attending classes. Therefore, in these cases, teachers must be flexible on assessment if attendance is compulsory.

Adaptation on laboratory internships → It is very important that the student understands clearly what to do and how to do it before working in the laboratory, otherwise serious accidents may occur.

At the Faculty of Chemistry of the UB some adaptations have already been made to ensure that students will be able to acquire all the possible knowledge from the internships. For example, by allowing them going to two different shifts, so that they have more time to do everything calmly. In addition, tutorials have been held before getting into the laboratory so that the teacher can make sure that the student has understood the script correctly.

Apart from these adaptations that are already being carried out, we believe that it would be very useful to have the practice scripts adapted with shorter sentences, diagrams, drawings or

images, numbering the steps to be followed, etc. In this way, students with comprehension problems such as dyslexia or those who lose concentration (ASD, ADHD, schizophrenia...) when reading a long text, would understand more easily the procedure to be carried out in the laboratory.

The adaptation of a current practice script could be one of the applications to be realized at the end of this study.

Reduced credit load and priority registration → These adaptations are more administrative than academic, but they can also help to improve the inclusion. They are generally applied in general for having a disability, and do not depend only on the faculty. The fact that they could have priority when registering and choosing subjects, will allow them to have a timetable with more breaks, better adapted to their daily life. These adaptations could help on their organization during the course, which is very important for SEN students because this also gives them more autonomy.

Audio recording lessons → Until recently this was inconceivable, because neither classrooms nor teachers were prepared. Today, after the covid-19 pandemic, everything has changed and due to the online teaching, which has been taken place the last two years approximately, it could be a possibility.

Is it true that the fact that students with difficulties, who often find it difficult to concentrate for the whole lesson, could watch the lessons again will enable them to understand them better. On this way, they can stop them when they need to rewind or take notes more calmly, for example.

However, a face-to-face class and an online class are very different to make for the teacher, and it is almost impossible to do both at the same time, because his position in class, the use of the blackboard or the projections, for example, are done in a very different way.

Consequently, the only solution will be for the teacher to offer the recorded lessons of the pandemic year to all pupils, because let us remember again that SEN students should never have more benefits because of having a disability and these recordings should be available to all. But recording the current lessons with students in class is not a viable way of making the recorded lessons accessible and we consider it is a difficult adaptation to make.

This would be another way of providing additional material.

Changes in group works → Group works are one of the biggest fears for many SEN students, especially for those with social phobias such as people with autism spectrum. As UB's Dra. Isabel Paula explains in detail in her presentation⁵ at one of the UNIDISCAT's workshops, one of the biggest disadvantages for them is that they have persistent deficits in communication and social interaction, which makes it difficult to work in a team.

It is always important to give to the pupil a chance, trying to get him to make his own group, thus greatly improve his fear of social interaction. If the pupil has difficulties in this, teachers will look for a group that they consider best for him. The aim is to ensure that he does have the least difficulties in adapting and working, and at the same time do not hinder the smooth of the group.

Again, the anonymity of the SEN student should always be preserved, giving him the opportunity to interact without other knowing about his difficulty. If teachers observe that the group is not functioning well and that this may be related to the SEN pupil's difficulty in adapting, they will inform the group or one of its members about his classmate's difficulty, always with the intention of helping him or her and making it clear that this will not affect their assessment.

This has been the way of acting in the Faculty of Chemistry of the UB to date in front of group works, as we have been informed by the inclusion tutor of the faculty, who is also the tutor of this project. We consider this is a very good way of acting and we believe that it should be maintained in the future.

Relaxing rooms → This measure has been requested by some SEN students and consider it could be very beneficial, especially for those with Asperger's syndrome. As we have seen in the work prior¹ to this, it is done in other universities and leads on great results. However, we believe that it would not be of much nowadays, because people with difficulties still feel stigmatized in our society and probably many would not go there in order not to be identified as different. Universities where it takes place are located in countries where people with disabilities are more integrated in everyday life, such as Northern European countries.

With the aim of completing the preliminary study in order to continue according to the method, once we have studied the set of measures carried out in other universities, which the comparative study¹ prior to this one shows us, the ones we consider viable to continue or to implement in UB's Faculty of Chemistry are the following:

- 1) **Support program.**
- 2) **Inclusion tutor.**

- 3) **Awareness of students' condition.**
- 4) **Complementary material.**
- 5) **Adaptation on internships.**
- 6) **Reduced credit load and priority registration.**
- 7) **Changes in group works.**

It should be noted that these adaptations must be proposed, discussed and approved by both the inclusion tutor and the student. In addition, it is very important to study each case and apply those that most facilitate inclusion, as not all students have the same needs.

This is very important to bear in mind because, as Kristen R. Brown cites in her article⁶ for the magazine 'Journal of Postsecondary Education and Disability', the vast majority of the literature of students with disabilities shows that cooperation between social engagement, positive teachers' attitudes and easy access to accommodations is essential for their academic success. In other words, in order to achieve successful inclusion of the student, the set of proposed accommodations must always go hand in hand with the student's willingness and acceptance to make them, as well as with monitoring and support from the inclusion tutor and teachers.

6.2 OPINION RESEARCH AND DETERMINATION OF DEFINITIVE ADAPTATIONS

Once the previous study has been completed, in which different measures to improve the inclusion of SEN students have been analysed and those considered most appropriate have been presented, we proceed to extend this study by asking the opinion of the students themselves, as well as of that of the teachers of the degree.

This method of going in depth in the study is one of the objectives of my final degree project, so the surveys have been prepared specifically for this purpose. However, it is also a fundamental part to consolidate the adaptations that will finally be applied. In consequence, and taking into account that the Inclusion Program depends on the Academic Vice-Deanship, permission has been requested from this organism to carry out these surveys.

As soon as the results of the surveys have been analysed, the list of adaptations will be aligned with the regulations of the inclusion plan without modifying the teaching plans.

6.2.1. Students' survey

6.2.1.1 Preparation and drafting

The survey for students has been sent to those who are under the supervision of the SEN PAT. Although there are more students with difficulties who are under the inclusion program, some have had the adaptations made directly by their academic tutor for different reasons such as maintaining the trust established between them or avoiding the worsening of the improvements achieved, and consequently the survey has not been sent to them.

It has been presented to the students as a collaborative project of the Inclusion Program with the support of the Academic Vice Dean's Office of the Faculty, to encourage their collaboration.

Through the survey they were asked whether they would find each of the accommodations proposed helpful, both for the assessment and during the course. The aim is to find out which ones are most beneficial to them in order to improve their inclusion in the degree.

In addition, it has been distributed through the inclusion tutor, to preserve their right to anonymity. Consequently, the survey has been answered completely anonymously and students did not have to identify themselves to answer it.

This survey can be found in Appendix 2. It has also been prepared in Catalan and has been sent to them in both languages, so that they can answer in the language of their choice.

6.2.1.2 Collection and processing of survey data

The survey was sent to 20 students who are part of the SEN PAT, of whom 17 responded, representing 85% of the total number of surveys sent out.

It should also be noted that 100% of responses have been in Catalan, and therefore only the percentages obtained in the Catalan survey will be taken into account.

As can be seen in Appendix 2, students were first asked about adaptations in the assessments. This part is based on six questions, one for each adaptation mentioned that could improve the current inclusion program in section 6.1.1 of the preliminary study, in which only one answer can be selected. Then, they were requested to rank the adaptations according to the level of help or support they felt they provided. The results and their analysis are shown on the next page.

- Question 1:

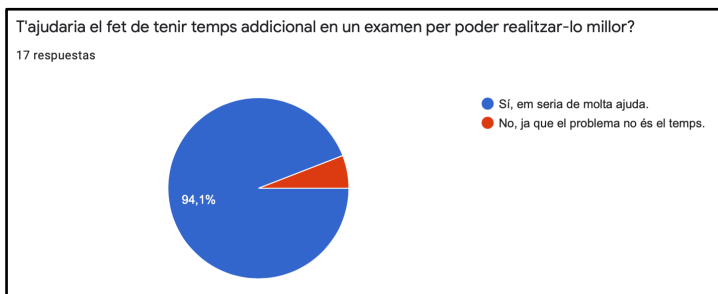


Figure 1. Result on whether extra time in an exam would help to perform better.

Firstly, it can be observed that 94.1% consider it very helpful to have extra time to be able to take the exams, which is a high majority. Moreover, as will be seen later in the bar charts, which show the order of preference of the measures, this has been chosen by almost all students and is therefore considered to be one of the best important adaptations to be made for SEN students.

- Question 2:

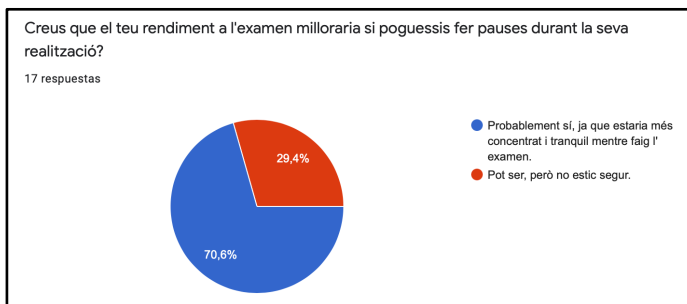


Figure 2. Result on whether having breaks would improve exam performance.

70.6% think that their performance in the assessments would improve if they could take breaks. This is also a high percentage in favour of this measure, which indicates that it would probably be useful for all of them. However, due to the fact that it may differentiate them from the rest of their colleagues and the fear of having to explain why they take breaks, they prefer not to accept it.

- Question 3:

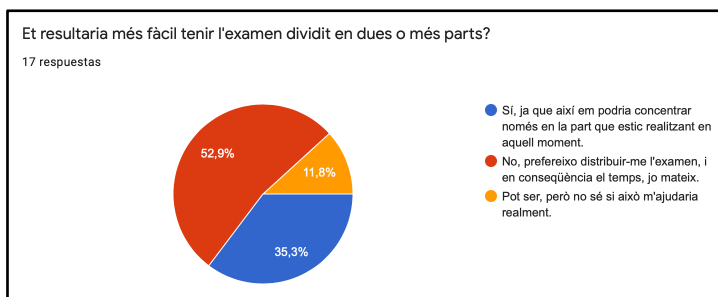


Figure 3. Result on whether it would be easier to have the exam divided in parts.

In relation to the question about the possibility of having the exam divided into parts, the majority, with a percentage of 52.9%, affirm that this would not make it easier for them to take the exams. While 35.3% believe it would and 11.8% have doubts about the effectiveness of this measure.

- Question 4:

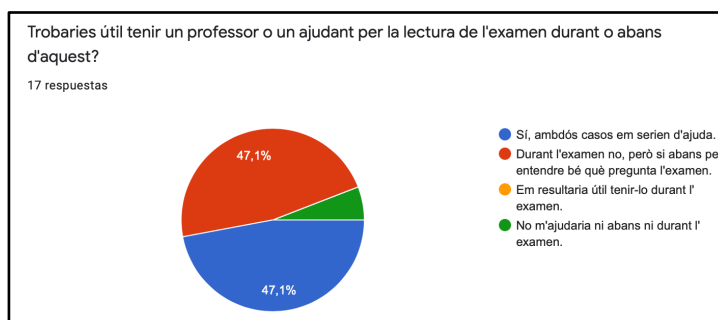


Figure 4. Result on possible reading aids before or during the test.

When asked about the possibility of having a teacher or assistant, during or before the exam, the students' responses are quite remarkable. In general terms, this adaptation has been very well received in the survey, since although in the partial percentages it does not seem so because the answers are mixed, more than 90% have shown that it would be useful for them.

More specifically, it is very significant that only 5.8% consider that they do not need help, compared to 94.2% who do. This suggests that almost all SEN students do not feel confident in front an exam and need help or support to cope it calmly because they do not know if they will

be able to understand it, and being able to read it beforehand allows them to face it with more confidence.

Furthermore, it is reflected that all of them would be grateful to receive help before the exam, and only half of them would be indifferent whether it is before or during the exam, as long as they receive it. It can be seen because the percentage for these two answers is the same (47.1%).

- Question 5:

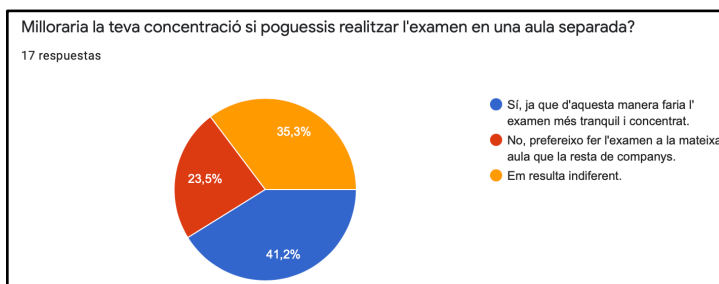


Figure 5. Result on whether taking the exam in a separate room would improve concentration.

Again, the responses to the question of whether it would be beneficial for them to be able to take the exam in a separate classroom are very varied. Although the highest percentage is for yes (41.2%), there are a large number of students (35.3%) who consider it indifferent whether do take the exam with their classmates or separately, and a 23.5% prefer to do the exam in the same classroom as the rest of the classmates.

- Question 6:

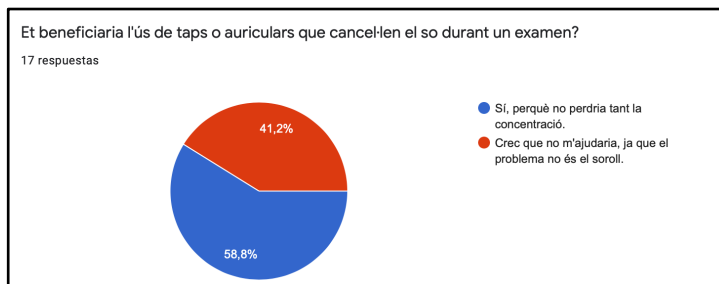


Figure 6. Result on the use of sound-cancelling headsets.

In relation to the last question presented to the students, 58.8% of them believe that it would be helpful to wear sound-cancelling headsets during the exams, which represents the majority, but very close to the half.

To conclude the section on adaptations in assessment, they were asked to rank them in order of preference. The proposals that would help them most are shown below, ranked according to their answers.

For each adaptation, the number of pupils is indicated on the ordinate axis and the number of the preference on the abscissa axis.



Figure 7. Result of the ranking of adaptations by preference.

This part was followed by questions about course adaptations, again with single-answer questions. The results were the following ones:

- Question 1:

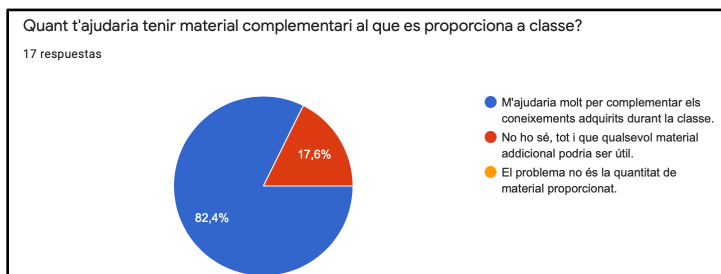


Figure 8. Results on the possibility of having additional material.

First, in relation to the amount of material provided in class, 82.4% believe that having complementary material would be very useful to complement their knowledge, and 17.6% are in doubt but consider it possible. Moreover, no one thought that the material is sufficient.

This was to be expected, as most of them feel insecure about what they have perceived in class and having more material would make them more confident to study and understand the concepts. Moreover, SEN students are the ones who will use it the most and, at the same time, they will feel more comfortable than with other adaptation because it will not be only offered to them, but to everyone, even if they are the ones who need it most.

It can also be assumed that 17.6% must be students with less learning-related difficulties.

- Question 2:

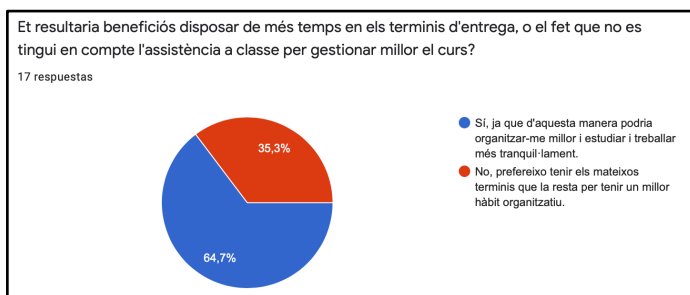


Figure 9. Results on deadlines and class attendance.

When they are questioned about the possibility of having longer deadlines or the fact that attendance might not be taken into account, the answers are more divided than in the previous questions.

There is a majority of 64.7% who believe that these measures would allow them to organize themselves better, but there is a good percentage (35.3%) who consider that having the same rules as others will make them more organized and productive.

This question can be difficult for students to answer, as there are several aspects that can influence on it. In general, the aim is to make it easier for the student with difficulties to organise themselves, but having these adaptations may suppose that they feel singled out. It depends on different factors and students' situations, specially it depends very much on their type of difficulty, because if they have dyslexia or ADAH, they may ask for help from peers and do the work in the same time as others. Whereas if their difficulty is any ASD, for example, if they are blocked in doing the work, they will not ask for help and consequently feel more comfortable having more time.

Although this measure has been voted by a smaller majority than others for the reasons mentioned above, it can be of great help to a large number of students and should therefore be considered as one of the most important measures.

- Question 3:

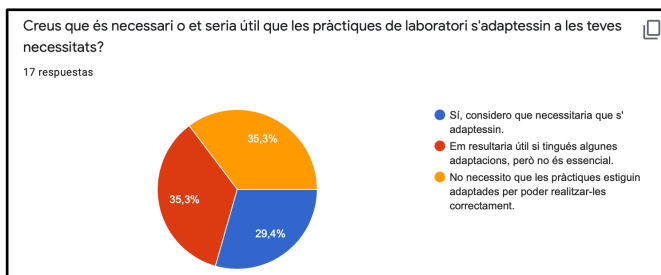


Figure 10. Result on adaptation of laboratory internships.

Regarding to the possible adaptation of laboratory internships, the responses are very evenly split between those who feel that is not necessary to adapt the internships (35.3%), those who say that it is not essential but useful (35.3%) and those who think that they should be adapted (29.4%).

These very equal percentages are probably due to the fact that this adaptation is more needed for one type of disorder than for others. For all those with social interaction problems it will be very useful to have the laboratory internships adapted, and surely the number of them in the inclusion program will match with those who had voted this adaptation as beneficial.

- Question 4:

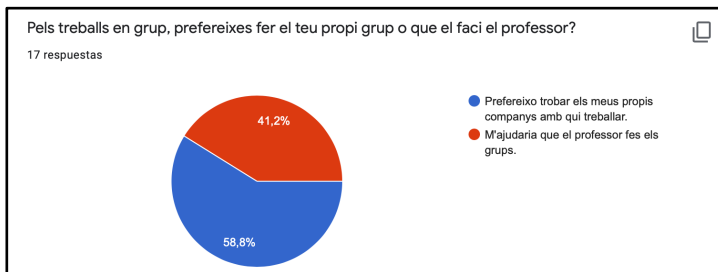


Figure 11. Result on how to do working groups.

Finally, in the last question with specific answer, the percentages are again very even, with 58.8% of students preferring to make their own group work, while 41.2% would be grateful if teachers would do this task for them. Again, it is likely that those who prefer teachers to make the groups are those with difficulties in social interaction, and some more for convenience.

As an observation, if the above percentages who preferred or found it more useful to have adaptations in the laboratory are added up, the total is close to an 60%, similar to those who prefer teachers to make the groups in this case.

Finally, there was a last question on whether they had received specific adaptations in secondary education and, if so, which ones. The results may be surprising, as most of them have not received any previous adaptations, and only 6 of the 17 students had received them before, which is only a 35.3% of all. This may be due to the fact that in secondary education there is a more personalised approach to students, and teachers take into account students' difficulties without having to establish specific adaptations.

The most frequently repeated adaptation in their answers is the right to have more time in the exams, as well as not taking into account spelling or expression faults in answers. Some of them also have received supplementary material.

These six students would probably be joined by those who have not received the survey, as they are students who would probably not have made it to the University without prior support.

6.2.1.3 Global analysis of the students' surveys

From the analysis of the students' responses to the survey, the aim is to determine which adaptations they find most and least useful. As can be seen, in some cases it is clear that the adaptation is helpful and necessary for them, as almost all or most of them agree, while in other cases the responses varied widely. This corroborates the main idea of the inclusion plan about the need to individualise each case of learning difficulties, as no two students are the same and therefore each one needs different adaptations.

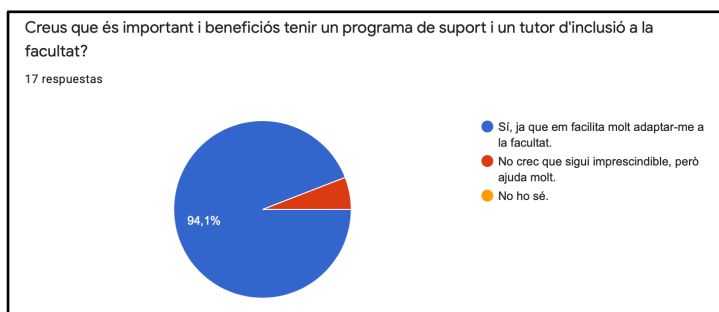


Figure 12. Result on inclusion program and inclusion tutor.

In addition, this fact is reinforced by the answers to the question about the inclusion program, which was asked to find out their perception on it and has obtained the following results:

It should be noted that the presence of an inclusion program is well accepted by SEN students, as well as the fact of having an inclusion tutor, with a 94.1% in favour. This question was not intended to cast doubt on this, but to find out how the students perceive it.

In conclusion, on the basis of the results obtained according to the students, none of the adaptations chosen in the preliminary study can be ruled out and, therefore, all those identified in section 6.1.1 and 6.1.2 are viable for improving the inclusion of SEN students.

6.2.2. Teachers' survey

6.2.2.1 Preparation and drafting

The survey for teachers has been sent to those who are familiar with the inclusion program, as they have at some point been involved and have had to implement adaptations. In this way, it

is possible to see in general terms how they perceive the Inclusion Program, in addition to completing the study of feasibility and effectiveness of the proposed accommodations.

This survey differs from the previous one because while students' survey allows us to know if the adaptations really help or benefit to improve their inclusion, the teachers' one lets us know their point of view on the application of these measures in the day-to-day classroom.

As in the previous case, permission has been requested from the Academic Vice-Deanship to send these surveys to the teaching staff as a collaborative project to the Inclusion Program.

Again, these surveys are completely anonymous and at no time their identity is revealed when answering them. They were also prepared in both English and Catalan so that each one could answer it in the language of their choice.

This survey can be found in Appendix 3.

6.2.2.2 Collection and processing of survey data

The survey was sent to 144 teachers and seventy-six responses were collected, giving a rate of 53%, so that more than half of the respondents have given their opinion on the adaptations proposed in the survey. Although it is not a very high percentage, it is considered sufficiently representative.

In this case there have been 74 answers in Catalan and only 2 in English, so the graphs shown are those of the survey in Catalan but the percentages that will be discussed will be calculated on the total number of responses.

To begin with, in relation to test adaptations, teachers had to select from a list those which

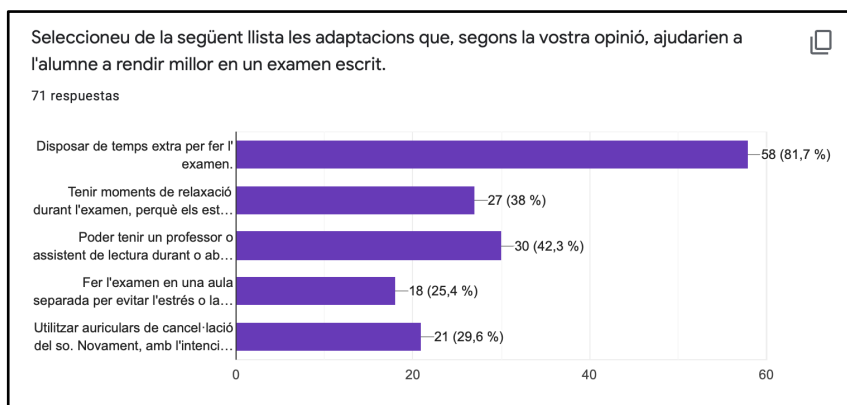


Figure 13. Result on adaptations considered viable and helpful by teachers.

they consider feasible to carry out and helpful for SEN students. The results are the follows:

As can be seen in the graph, all the proposals have been voted by a significant percentage, which indicates, firstly, that all of them are feasible in the opinion of the teachers and that none of them should be discarded.

It can also be seen that the most voted by far is the possibility of having extra time to take the exams, which coincides with the result of the students' opinion, who also selected this adaptation as the most beneficial for them. Next, came the fact of being able to have a teacher or assistant and having moments of relaxation with very similar percentages, around 40%. These two adaptations were also very well received by students. Lastly, with percentages also high enough to be taken into account are the measures on the use of sound-cancelling headsets and the fact of being able to take the exam in a separate room. This latter is the one that received the least votes, presumably due to the complication to carry it out, as it depends on having more teachers at assessment times.

After the classification, teachers were asked in an open-ended question whether they knew of other adaptations that would improve inclusion in assessment methods. There were only 11 contributors, of which the following opinions are the most coincident:

- The fact that each case is different and that it is very difficult to establish general measures with 4/11 responses providing this opinion.
This has been mentioned throughout the study and it has been emphasized that each case should always be studied specifically and those that the student considers to be of help should be adopted.
- Making the student feel confident before taking the exam, through a previous relationship between the student and the teacher during the course that makes them feel capable. Two out of eleven teachers had proposed this suggestion.
This measure is very interesting, as support has been offered before or during the exam to improve their confidence, but taking this confidence before the day of the exam through a closer relationship with the teacher to solve doubts or to clarify concepts can make them feel less fearful on the day of the exam as some of them feel.
- It is also argued that providing these adaptations for SEN students means overprotection or inequality in relation to others or a poorer preparation for the future, for example.

In no case the inclusion program intends to create these situations, nor inequalities, nor to undervalue SEN students in terms of their professional future. It is very important to stress that adaptations will never change the competences and skills to be acquired. Consequently, all the measures taken in each situation are aimed at ensuring equal opportunities for all students and only seek to improve social or learning inclusion by helping them to be at the same level as the others.

Once the questions about measures in assessments were completed, they were asked to rate five adaptations to improve inclusion in learning methods. Specifically, they were asked to rate each accommodation from 1 to 5, with 1 being the worst and 5 the best. The results obtained are shown below.

- Question 1:

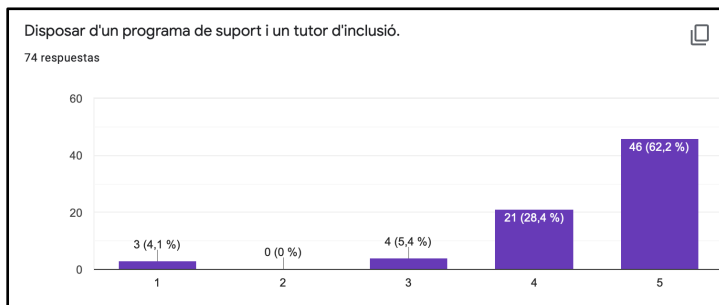


Figure 14. Result on inclusion program and tutor.

First of all, as far as the inclusion program and inclusion tutor are concerned, the vast majority gave it the highest score. This shows that teachers also welcome and find it helpful that the faculty has this inclusion program. Either because it makes easier for them to know how to act and what measures to take when faced with students with learning difficulties, or simply because they are alerted and can take this into account and avoid problems for the student beforehand.

In addition, almost all the rest of the people who did not rate it with the highest score, gave it a 4, and only less than 10% considered it useless or of little benefit, giving it lower scores.

- Question 2:

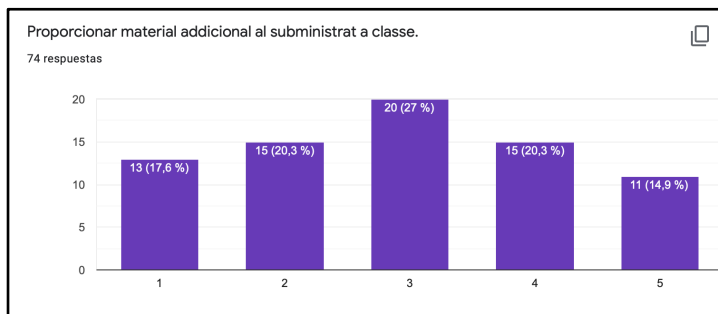


Figure 15. Result on giving additional material.

On the other hand, when asked about how much they think it would help SEN students to have additional material, the answers were very mixed. There is not a large majority on any score, with the highest score being the third, which means that they are very undecided.

These very even percentages may be due to the fact that it is considered that it would be beneficial for the student to have this supplementary material, but at the same time it is not very feasible to carry it out, perhaps because it is considered that the subject provides enough material to acquire the knowledge.

- Question 3:

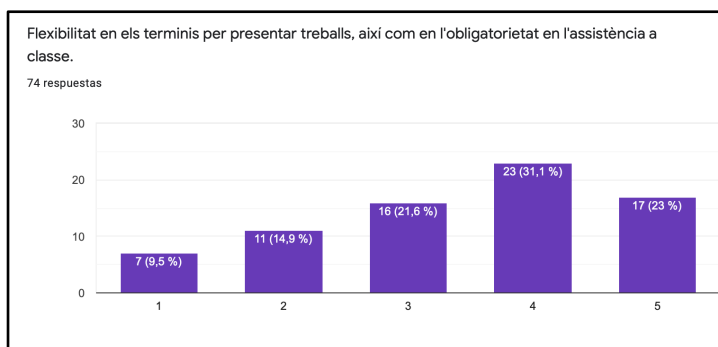


Figure 16. Result on deadlines and class attendance.

Next, in relation to the possibility of making the terms of presentation works more flexible or the fact of not taking into account the students' attendance in class, the opinions are very varied. The majority would consider it beneficial and feasible to carry out, as the highest

percentages are at scores 4 and 5, although there is a large proportion who rate it as 2 or 3, meaning that it could be helpful but not an essential adaptation.

The latter ones may be based on the teachers' belief that giving them the same time and rights as others makes them more organised, which is beneficial for coping with their disability, their studies and their daily life. However, most of them feel that it is more helpful to give them their time and avoid overburdening them with a specific deadline.

- Question 4:

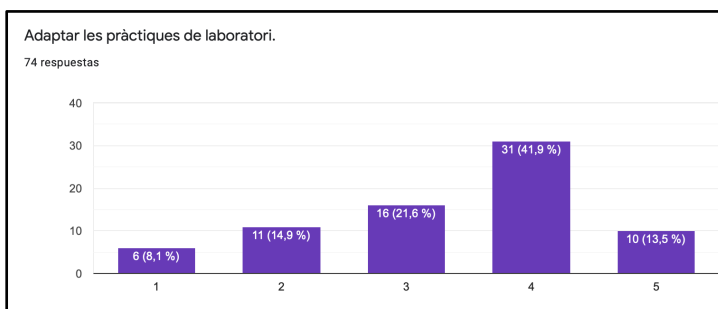


Figure 17. Result on laboratory's adaptation.

The question on adapting the laboratory internships shows that a large majority consider it very useful for the students, with more than 50% scoring it with 4 or 5 points. This result is very similar to the one expressed by students, since although more than half of them consider it convenient, it can be seen that it is not considered essential, and many of them value it with low scores.

This adaptation depends very much on the type of difficulty of the student, as this type of subject is more difficult to carry out for those with social interaction problems than for those with only learning problems.

- Question 5:

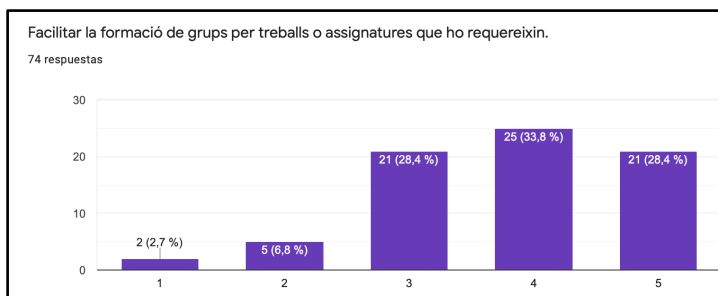


Figure 18. Result on how to make groups work.

The last adaptation that the teachers were asked about was the possibility of facilitating the formation of working groups in the subjects that require it. It can be seen that almost all the teachers think it is convenient and feasible to do. The large percentage of votes for the highest scores indicate that teachers could easily do this to help those students who need it.

It is important to remake, as it has been discussed in the analysis of this measure in the students' survey, that this adaptation is again related to the type of difficulty presented by the student, as it affects much more those with social interaction problems. Consequently, even if teachers had considered it easy to implement and beneficial for students, it would be only necessary to be applied in those cases that require it.

To conclude this section and the survey, they were asked again if they knew of any other possible adaptations to be made during the learning period. In this case, only six teachers responded with new ideas or opinions.

From the responses, it is worth highlighting the common opinion of some of them on the importance of the teachers being aware when a SEN student is present in their classes, in order to be able to have a more direct relationship with him or her during the course. This proposal is already implemented, as the inclusion tutor is always in contact with the students' teachers whether special measures are taken with the student or not, but it is considered essential that the teacher has to be aware of the situation of his students.

There is also reference to the difficulty of adapting laboratory internships in certain situations. This is true, but as has been noted, adaptations are made to guarantee equal opportunities for students and consequently adaptations will go as far as possible to help the student without altering the normal course of the subject.

6.2.2.3. *Global analysis of the teachers' surveys*

The aim of the teachers' survey is to determine which measures are most feasible to do without altering the normal order of the subject, as opposed to the students' survey, where the aim was to find out which were most beneficial.

Once the results obtained have been analysed, it can be concluded that none of the proposed measures can be discarded outright. It has been corroborated that the adaptations selected in the preliminary study as feasible to realise in the Faculty of Chemistry are also perceived as feasible by the teachers.

Obviously, some are considered more convenient or easier to carry out, and for teachers these have been the follows:

- **To have extra time in exams.**
- **To have a reading teacher or assistant, especially before the exam.**
- **To take relaxing times.**
- **Flexibility in terms of deadlines or class attendance.**
- **To adapt laboratory internships.**
- **Facilitating the formation of group works.**

Some of these adaptations coincide with those most liked by students and other do not, but in any case, all them proposed have been more or less accepted by both.

6.3 IMPLEMENTATION OF AN ADAPTATION

Going on with the approach of the work, the next objective to accomplish is to apply some of the adaptations recognised as viable to improve the inclusion in a subject of the teaching plan of the Chemistry Degree of the UB.

Among all the possible adaptations we have shown, we have decided that the one we will carry out will be to prepare and provide complementary material. In this way, an example of a possible type of additional material to offer to students will be presented.

6.3.1. Subject selection

We have decided to choose a laboratory subject in order to provide complementary material, because these practical subjects serve to comprehend in a better way the concepts explained in the theoretical ones, and consequently, by understanding these correctly, the concepts of both are better assimilated. In addition, we believe it is important for SEN students to have additional material* at their disposal if they need it, so that they do not simply follow the procedure without understanding what is chemically happening.

In addition, we have considered that it should be a basic laboratory, as it is where the foundations of the laboratory's methodological work are established. Moreover, in internships it is essential to know what is being done and why it is being done, because these first practices allow the basic concepts of the initial subjects of the degree to be assimilated.

The subject to which we are going to contribute with additional material is the Basic Laboratory of Analytical Chemistry. We have chosen this one because it is a very important subject of the degree, as it teaches essential concepts for subsequent laboratories and serve to assimilate several basic concepts of analytical chemistry for future subjects of this branch and even for other branches of chemistry. Even so, we could have chosen any other to start the adaptations, as all of them can be adapted to improve the inclusion of students.

6.3.2. Adaptation model

It can be observed that in the teaching plan for this subject there is a wide variety of recommended material to make these practices, most of them about analytical methods for different determinations, either in book or audio-visual format. In addition, in this subject, a book⁷ is used as a script to be followed, in which the previous explanation, the procedure and some observations to be taken into account can be found.

To facilitate SEN students' understanding and learning, the supplementary material we are going to prepare is the same text of the procedure with annexed comments that emphasise the most important parts to be taken into account and help to understand what is being done, and especially, why. We will mainly focus on explaining the chemical part of the procedure, since, as we have already mentioned, the teaching plan already offers quite material on the set-up and how to carry out the experimental work in the laboratory.

We will prepare the material for one of the practices that is currently being carried out in this subject, particularly one of the acid-base potentiometric titrations. The intention is that it can serve as a model for others to be adapted if it is considered appropriate in any case of the inclusion plan.

This model of adaptation bases on the provision of additional material can be found in Appendix 4.

*All students are provided with additional material, but in these particular cases we refer to material selected by the teacher, who may consider it essential for the good follow-up of the practices.

7. CONCLUSIONS

Once the bibliographic work has been completed in line with the objectives and methods set out, conclusions can be drawn that should be taken into account.

-The fact that there is an inclusion program in the Faculty of Chemistry of the UB benefits not only students, but is also of great help to teachers in front of situations with students with disabilities, as has been seen thanks to the good acceptance of this by almost all of them.

-Furthermore, it has been ratified that the inclusion program unifies criteria and makes all those involved go in the same direction, since sometimes the opinions on adaptations are very diverse and through the inclusion program it is possible to bring all parties together and resolve the needs of each case. This means that it is essential to individualise adaptations for each situation, but with a control so that equivalent opportunities exist in a fair way, establishing personalised adjustments but ensuring equality among all.

-It is observed that students prioritise adaptations in the assessment model, which suggests that teaching at the UB is quite advanced towards adaptation and equality of conditions and that it is the assessment methods that cause the most stress for SEN students. This is corroborated, and also surprising, by the low need shown by students to possible adaptations in laboratory internships. This is due to the fact that on these practices there is more personalised learning in which there is a lot of communication between student and teacher, apart from that among students, and this makes SEN students more comfortable despite being assessed.

-In relation to teachers, half of those consulted were interested in improving the inclusion of students with difficulties and gave their opinion. However, we consider that the other half did not find the right moment to answer them, as approximately 90% of the teachers who have had to implement adaptations at some point since the inclusion program has been in place have done so with good willingness.

-In short, taking into account that the responses obtained from students and teachers are quite positive and show a good predisposition, it can be said that one of the most important conclusions is that it opens a way for these adaptations to be applied to the standardised teaching of chemistry to universal design for learning.

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12. ACRONYMS

ADHD	Attention deficit hyperactivity disorder
ASD	Autism spectrum disorder
SEN PAT	Pla d'acció tutorial per alumnes amb dificultats educatives especials
SEN	Special educational needs
UB	University of Barcelona
UNIDISCAT	Universitat i Discapacitat a Catalunya
CIC	Consell Interuniversitari de Catalunya

APPENDICES

APPENDIX 1: OPERATION MODE OF THE INCLUSION PROGRAM OF THE FACULTY OF CHEMISTRY OF THE UB

SEGUIMENT ESTUDIANTS PROGRAMA D'INCLUSIÓ

El Programa d'Inclusió que té com objectiu fer el seguiment dels alumnes amb necessitats educatives especials per tal d'adaptar els aprenentatges i models d'avaluació a les seves necessitats, sense que de cap manera s'alterin els continguts en quant a coneixements a adquirir o les habilitats a desenvolupar en cada assignatura.

INCORPORACIÓ AL PROGRAMA

- Informació SED
- Informació SAE
- Informació Tutor Acadèmic, Cap d'Estudis o professors de l'estudiant no acreditat.

PRIMERA ACTUACIÓ

- El tutor d'inclusió elabora un cens d'estudiants partir de:

Consulta a la SED sobre quins alumnes tenen reducció de matrícula,

Consulta al SAE sobre alumnes de la Facultat de Química que han sol·licitat entrevista i estan pendents de ser avaluats. Dels alumnes que ja han estat avaluats el SAE envia informe , tant el Cap d'Estudis com el tutor d'inclusió.

Informació procedent dels Tutors acadèmics que tenen coneixements d'alumnes amb necessitats específiques d'aprenentatge.

Informació de professors que tenen sospita de tenir estudiants amb necessitats especials.

PLA DE TREBALL:

- A) Estudiants de nova incorporació al programa

- Es recull informació de l'estudiant (tutor acadèmic, any d'ingrés, expedient acadèmic, assignatures matriculades,...)


- Es contacta amb el tutor acadèmic per informar-lo del cas, si és que encara no té la informació.
- El tutor acadèmic informa a l'estudiant sobre el Programa d'inclusió al passar la primera tutoria i, si l'estudiant hi està d'acord, posa en contacte a l'estudiant amb el/la tutor/a d'inclusió per iniciar el seguiment.
- Es fa una primera tutoria per conèixer les dificultats específiques de l'estudiant. Si ja es disposa d'informe del SAE, les dificultats i recomanacions genèriques ja es coneixen. Si l'alumne no ha estat entrevistat pel SAE se'l redirigeix cap a aquest servei però, a l'espera de tenir un informe oficial, es comencen les accions d'inclusió.
- Es revisen els plans docents de cada assignatura per detectar les dificultats d'aprenentatge i avaluació que pot tenir l'estudiant, a fi de poder fer les recomanacions el més adaptades possible.
- S'informa als professors de les assignatures matriculades sobre les dificultats d'aprenentatge de l'estudiant i les recomanacions per adaptar aprenentatges i models d'avaluació.

B) Estudiants incorporats al programa

- Atès que ja es coneixen les dificultats genèriques de l'estudiant, un cop iniciat el curs o semestre, es deixen passar una o dues setmanes i es fa una primera tutoria per a que l'estudiant indiqui con està seguint el curs i quines adaptacions creu que el podrien ajudar. Es discuteix i pacten aquestes adaptacions per a, posteriorment, parlar amb els professors i fer les recomanacions pertinents.

Les recomanacions fetes al professors són revisades per aquests que les poden modificar segons el seu criteri i model d'avaluació.

APPENDIX 2: MODEL OF STUDENTS' SURVEY



UNIVERSITAT DE
BARCELONA
Facultat de Química



STUDENTS' SURVEYS

Dear students,
In order to improve the actions started by the Inclusion Program of the Faculty of Chemistry of the UB, with the consent of the Academic Vice-Deanship, we would like to know your opinion about this program.

To this end, we would you to assess through the following survey, the suitability of a number of adaptations that are already in place or are being studied to implement in the near future. Please observe that they are all aimed to improve inclusion both in learning and assessment.

Consequently, we ask you to answer the survey as honestly and rigorously as possible, to find out whether these adaptations really help you or not.

Note that your response will be anonymous and that your information will only be used to determine the feasibility of the adaptations proposed.

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EXAMS ADAPTATIONS

WE WILL BEGIN BY ASKING YOU ABOUT THE ACCOMMODATIONS THAT CAN BE MADE TO ASSESSMENT METHODS, AND MORE SPECIFICALLY TO EXAMINATIONS.

Would it help you to have extra time in an exam to perform it better? *

Choose one answer

Yes, it will be very helpful.
 No, the problem is not the time.

Do you think you would improve your exam performance if you could have breaks? *

Probably yes, I would be more focused and calm while taking the exam.
 I don't think so, I will get more nervous during the breaks.
 Maybe, but I am not sure.

Do you find it easier for you to have the exam divided into two or more parts? *

In this case you would be given the exam in parts, so that each time you hand one part you would be given the next part. Each part will have an allowed time and there would be shork breaks between parts to regain your level of concentration.

Yes, so that I can concentrate only on the part I am doing at the time.
 No, I prefer to distribute the time myself.
 Maybe, but I don't know if it would help.

Will you find it useful to have a reading teacher or assistant during or before the exam? *

If it is done during the test, it would be in a separate room, so that it not interfere others' concentration. Whereas doing this before the exam would allow you to take the exam together with the others.

- Yes, it would help in both ways.
- Not during the exam, but yes before to get a clear understanding.
- I will find it helpful to have it during the exam.
- It would not help me before nor during the exam.

Would it improve your concentration if you could take the test in a separate room? *

- Yes, it would help me to take the exam calmer and more focused.
- No, I prefer to do it in the same classroom as the others.
- I am indifferent.

Rank the assessment adaptations according to the level of support they will provide you. *

Assign number 1 to the one that benefits you the most and 6 to the less.

	1	2	3	4	5	6
Have extra time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relaxing times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Split the exam into two or more parts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reading teacher or assistant during the exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make the exam in a separate room.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use cancelling headsets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[Atrás](#)

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COURSE ADAPTATIONS

YOU WILL NOW BE ASKED ABOUT ADAPTATIONS WE HAVE PROPOSED THAT CAN BE IMPLEMENTED TO IMPROVE INCLUSION DURING THE COURSE.

Do you think it is important and beneficial to have a support program and an inclusion tutor in the faculty? *

- Yes, it makes it much easier for me to adapt to the faculty.
- I don't think that it is essential, but it helps a lot.
- I don't know.

How much would it help you to have complementary material to that provided in class? *

Supplementary material could be a summary or an outline about the class before or after it, videos about the concepts explained, power points...

- It would help me a lot to complement the knowledge acquired during the class.
- I don't know, although any way of getting more material would be useful.
- The problem is not the quantity of the material provided.

Would it be beneficial for you to have more time on deadlines, as well as not having your class attendance into account, in order to manage the course better? *

- Yes, in this way I could organise myself better and study and work in a calmer way.
- No, I prefer to have the same deadlines as others in order to have a better organisational habit.

Do you find it necessary or would be it helpful if the laboratory internships were adapted to your needs? *

These adaptations would be both in relation to the time needed to carry out the internships, as well as to the fact of having adapted the material to be used in order to understand what to do, for example.

- Yes, it is necessary to adapt them for me.
- I would find it helpful if they had some adaptations, but it is not essential.
- I don't need the internships to be adapted in order to do them successfully.

For group work, do you prefer to do your own group or have it set by the teacher? *

- I prefer to find my own partners to do the work with.
- I would prefer the teacher to do the work teams.

Atrás

Siguiente

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To conclude,

During secondary education, have you had any specific learning adaptations? *

- Yes
- No

If the answer is yes, which ones?

Tu respuesta

Atrás

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APPENDIX 3: MODEL OF TEACHERS' SURVEY



UNIVERSITAT DE
BARCELONA
Facultat de Química

TEACHERS' SURVEY

Dear Professor,

In order to improve the actions started by the Inclusion Program of the Faculty of Chemistry of the UB, with the consent of the Academic Vice-Deanship, we would like to know your opinion about this program.



The Inclusion Program aims to monitor SEN students in order to adapt their learnings and assessment models according to their needs, without disrupting the content to be acquired or the skills to be developed in each subject.

To this end, we would you to assess through the following survey, the suitability of a number of adaptations that are already in place or are being studied to implement in the near future. Please observe that they are all aimed to improve inclusion both in learning and assessment.

Consequently, we consider that your information is essential when suggesting and valuing possible new adaptations, as well as when reconsidering the existing ones.

Note that your response will be anonymous and that your information will only be used to determine the feasibility of the adaptations proposed.

Thank you in advance.

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EXAMS ADAPTATIONS

Firstly, you will be asked about the applicable measures to assessment methods. These have been previously studied and are considered feasible to implement in the faculty.

Please select from the list below the adaptations that, in your opinion, would help the learner to perform better in a written exam.

Select the adaptations that you consider feasible to do in the exams and which could help students with learning difficulties to perform them better.

- Have extra time to take the exam.
- Have relaxing times during the exam, so that students will not be stressed and can concentrate more.
- Split the exam into two or more parts. In this case the exam would be done in parts. Each part would have an allowed time and there would be breaks between parts to regain their level of concentration.
- Have a reading teacher or assistant during or before the exam. It would be possible to meet with the teacher before the exam to read it and ask questions if something has not been understood. While if it is done during the exam, it should be done in a separate room.
- Make the exam in a separate room in order to avoid stress or lapse of concentration, for example.
- Use of cancelling headsets. Again, to enable them to focus better on the exam and to facilitate a successful completion of the exam.

If other accommodations or suggestions for improving inclusiveness in assessment methods come into your mind, please write them below.

Tu respuesta _____

Atrás
Siguiente
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COURSE ADAPTATIONS

You will now be asked about the proposed adaptations to improve the inclusion of SEN students during the course.

Please rate each possible adaptation on a scale of 1 to 5 according to how helpful you think it would be for students without disrupting the normal course of the class.

Assign number 1 to the ones you consider less useful and 5 to the most convenient ones, and so on respectively.

Have a support program and an inclusion tutor. *

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Provide with complementary material to that given in class. *

This would be given to all students, considering that it can be of more help to those with learning difficulties. Supplementary material could be a summary or an outline about the class before or after it, videos about the concepts explained, power points...

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Giving more time on deadlines, as well as regarding class attendance. *

In this way they could better organise their work and the semester in general.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Adapt laboratory internships. *

These adaptations would be both in relation to the time needed to carry out the internships, as well as to the fact of having adapted the material to be used in order to understand what to do, for example.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Facilitating the creation of groups for work or subjects that require it. *

Depending on each case, the student would be left to find his own partners or the teacher would be in charge of making the groups.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Again, if you know of any other possible adaptation to improve the inclusion of students in class, please write them below.

Tu respuesta _____

Atrás

Siguiente

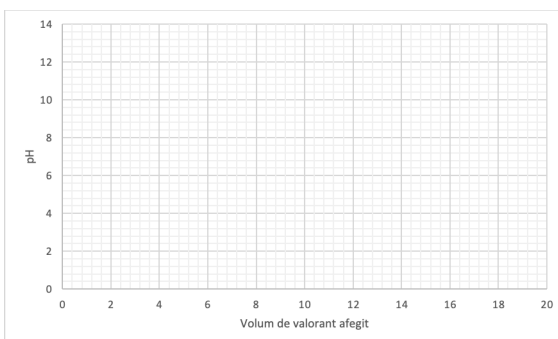
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APPENDIX 4: MODEL OF ADAPTATION OF A PRACTICE SCRIPT FOR THE BASIC LABORATORY OF ANALYTICAL CHEMISTRY

10.1.1. Valoracions Potenciomètriques àcid-base

Quan es té una mostra composta per una barreja de dos àcids o de dues bases de diferent força, es pot determinar el contingut de cadascun mitjançant una valoració potenciomètrica, que consisteix en la representació gràfica dels parells de punts corresponents a la lectura de pH (o de potencial) i al volum de valorant afegit.

→ *Es representa el pH a l'eix Y en funció del volum de valorant afegit a l'eix X per obtenir la gràfica.*



Il·lustració 1. Gràfica per omplir amb els resultats obtinguts.

La corba de valoració permet la determinació dels punts finals, i a partir d'ells, de la concentració de cadascun dels components que constitueixen la mostra.

→ *El punt d'equivalència correspon al punt teòric en el qual s'han barrejat exactament quantitats estequiomètricament equivalents de reactiu i valorant.*

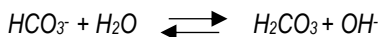
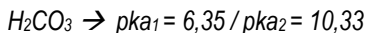
→ *El punt final és l'aproximació experimental al punt d'equivalència.*

C) BARREJA DE Na_2CO_3 I NaHCO_3

En primer lloc s'ha de considerar el tipus de mostra per seleccionar el valorant adequat.

→ *En aquest cas es tracta de dues bases, de manera que caldrà que el valorant sigui un àcid fort.*

→ *Cal tenir en compte els valors de les constants de dissociació àcida de l'àcid carbònic i les reaccions que es produiran:*



→ *Els valors de pka serveixen per conèixer els punts de dissociació àcida, però en aquest cas les reaccions que es produiran són les contràries, i per tant caldrà conèixer els valors de pkb. **Cal trobar la fórmula que relaciona el pka i pkb.***

En segon lloc, s'ha de realitzar una valoració visual prèvia que permeti avaluar el número de punts finals, o salts, previsibles a la corba de valoració i a la neutralització de quina espècie, o espècies, correspon cadascun d'ells.

→ *Per triar l'indicador adequat cal saber a quin pH es produeixen les reaccions, de nou cal tenir en compte els valors de pkb. **L'indicador cal que viri en un interval que inclogui el valor de pkb de la base.***

→ *En aquest punt, tenint en compte les reaccions que es produiran i la valoració visual prèvia, **convé anotar quina espècie predominarà en cada rang de pH per tal de tenir-ho més clar en la potenciometria.***

Un cop es coneix a quins pH es produiran els salts, es pot realitzar la potenciometria seguint el procediment.

S'entén com a salt d'una corba de valoració la variació brusca de pH o potencial que s'observa al voltant d'un punt d'equivalència i a partir del qual es pot determinar el punt final.

Determinació

Es prenen, amb pipeta, 25ml de mostra (la concentració de les quals hauria de ser de 0,02M, en cas contrari cal canviar el volum que es pren de mostra).

S'introdueixen en un vas de precipitats de 100ml i es col·loca el sistema electròdic (elèctrode combinat o parell d'elèctrodes vidre-referència) de mode que el bulb de l'elèctrode de vidre i la unió de l'elèctrode de referència quedin coberts per la solució. Si cal, es pot afegir aigua desionitzada per cobrir-los.

Observació: L'aigua només es pot afegir abans de començar la valoració, ja que l'elèctrode de vidre mesura l'activitat de l'ió H_3O^+ .

Es col·loca el sistema muntat sobre la placa d'un agitador magnètic. Es col·loca una bureta de 25 ml plena i enrasada amb el valorant triat, de mode que l'extrem inferior toqui la cara interna del vas. A continuació, s'introdueix un nucli magnètic al vas i es posa en funcionament l'agitador. Es deixa passar una estona en agitació fins que s'estabilitza la lectura i s'apunta el valor de pH inicial.

A continuació s'addiciona valorant, s'agita, es deixa establir la lectura i un cop s'ha establitzat, s'apunta el valor de pH. Es repeteix el procés per cada addició de valorant, anotant la relació de volum de valorant afegit i el pH de la solució després de cada afegida.

→ *S'ha de calcular el volum total de valorant aproximat que es gastarà perquè es doni cada salt en la gràfica.*

→ *Cal tenir en compte el volum inicial de mostra, la concentració del valorant que s'usarà i el factor d'estandardització d'aquest. És imprescindible conèixer les reaccions i l'estequiometria d'aquestes, en funció del l'àcid usat.*

$$V_{\text{àcid primer salt}} = \text{_____ ml}$$

$$V_{\text{àcid segon salt}} = \text{_____ ml}$$

$$V_{\text{total}} = \text{_____ ml}$$

→ *Una altra alternativa és realitzar dues potencioimetries, primer amb volums més grans de valorant (1 ml) i quan ja se sap a quins volums es produeixen els salts, realitzar una nova potencioimetria amb volums més petits (0,1 – 0,2 ml) en les zones més pròximes als salts. Així la gràfica serà més detallada i els càlculs més exactes.*

Volum gastat (ml)	pH
1	
2	
3	
4	
...	

Taula 1. Model de taula per anotar els resultats experimentals

Un cop finalitzat el procediment experimental, cal dibuixar la gràfica per poder determinar els punts finals i calcular les concentracions inicials de mostra.

→ *Tenint en compte la definició de punt final, el volum de valorant que marca aquest punt correspon a la quantitat d'àcid necessari perquè la quantitat de substància valorant sigui estequiomètricament igual a la d'anàlit o component inicial. A partir d'aquests volums es pot calcular la concentració real de CO_3^{2-} i HCO_3^- .*

$$[\text{CO}_3^{2-}] = \text{___} M$$

$$[\text{HCO}_3^-] = \text{___} M$$

→ *El volum del segon salt cal trobar-lo per diferència entre el volum total de valorant gastat i el del primer salt.*

→ *El punt final s'estima en el punt mig del tram de canvi brusca en la forma de la gràfica, tot i que se sol utilitzar la primera derivada dpH / dml , sent el valor més alt de la derivada el que es correspon al volum corresponent al punt final de la reacció.*

Qüestions

→ *Aquestes preguntes les has anat resolvent en el transcurs de la pràctica. Només cal buscar en el procediment i en les anotacions preses durant la realització.*

- 1- Quines espècies predominen?
- 2- Quines són les espècies predominants en cadascun dels punts d'equivalència?
- 3- Per què no es pot afegir aigua en el decurs d'una valoració potenciomètrica?
- 4- Quins indicadors poden utilitzar-se en la determinació dels components de la mostra?
- 5- Expressa el resultat de la mostra valorada en g/L i mol/L.

→ *Cal tenir en compte la massa molar (g/mol).*

$$[\text{CO}_3^{2-}] = \text{___} M$$

$$[\text{CO}_3^{2-}] = \text{___} g/L$$

$$[\text{HCO}_3^-] = \text{___} M$$

$$[\text{HCO}_3^-] = \text{___} g/L$$

- 6- Per quines raons triaríeu una valoració potenciomètrica enlloc d'una valoració amb indicadors visuals?

