

USING THE INTERNET TO ASSIST STUDENTS AND GUIDE THEM TO SUCCESS

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1 INTRODUCTION

The goal of this paper is to present the system « Le ChemiNot^{*} » conceived and realised at the École de technologie supérieure (ÉTS) by the author. The « ChemiNot » is a system entirely written in Java that students (and authorized staff) can use to consult their academic file (courses chronology and grades, personal information, admission decisions, etc.) and to register to classes using Internet.

Our University always took pride in following very closely the academic evolution of its students. Even if advisors and department directors were trying to keep track of everything, the fact that all transactions related to registration were done on paper renders the objective illusive. We built the system « ChemiNot » with three simple concepts in mind : eliminate revisions, guide the student when he is registering, and advise him. First, we wanted to have a system that could show in multiple formats the academic file of a student so administrative staff could evaluate more rapidly and efficiently the situation of a student and advise him properly. Second, we wanted the system to be able to handle every general situation that occurs when students are registering. In our mind, the system should, for example, automatically check prerequisites and schedule conflicts in order to completely eliminate manual revisions or multiple schedule changes at the beginning of the semester (when the student realizes that his schedule presents a conflict). Finally, we wanted the ChemiNot to give some advices to the student (warning him of special deadlines, informing him about academic regulations, etc.). The system ChemiNot incorporates these three desiderata. In so doing, advisors and managers can now give more time to students which really have difficulties (for this purpose the system always refers those students to an advisor) instead of doing straightforward and boring revisions.

After a brief presentation of the system and its possibilities, we will describe how the system manages and shows information regarding students (data bases needed, management of changes in curriculum, courses followed in other universities or countries, etc.). We will then proceed to present the advising possibilities incorporated in the system. An overview of possible implementations of this system in other universities and its expansion possibilities concludes this paper.

* « ChemiNot » is a French acronym made out of the words « cheminement » (progress) and « notes » (grade). A good translation might be « ProGrade ». The word « cheminot » also means « railworker » in French.

2 OVERVIEW OF THE SYSTEM

The ChemiNot is accessible on Internet (<http://www.etsmtl.ca/cheminot/>) by every student and the authorized staff of the Superior School of Technology¹. The system is built around three operating modes : the « Consultation » mode, the « Registration » mode (in French « Inscription ») and the « Help » mode. Within the Consultation mode, the user has access to five types of information presented with the help of tabs : « General information », « Compressed curriculum », « Graphical curriculum », « Courses chronology » and « Grade evolution ».² Within the Registration mode, the user has access to three tabs : « Choice of courses », « Schedule », « Correspondences ».³ The « Help » mode offers a contextual help page for the tab presently selected in the Consultation mode or the Registration mode.

2.1 Consultation mode

The tab « General Information » presents sociological and personal information, general academic information and admission decisions (see figure 1).

Consultation		Inscription H98	Aide	Quitter
Info. générales Chemin. comprimé Chemin. graphique Chronologie cours Évolution moyenne				
BASA25106909 ANDRE BASSIL (A)		Etat du dossier: (E) 15 crédits réussis +23 inscrits		
Profil : Électricité (B)		Etudiant en sanction graduée (D) Moyenne cumulative: (F) 1.72/4.3		
7883 BACCALAURÉAT EN GÉNIE ÉLECTRIQUE (C)		(G) Taux d'abandon : 11.1%		
Adresse : 265 RIVERSIDE APP.0009 ST-LAMBERT J4P 1A4		Première session : H97 à temps partiel (I) Dernière session : H98		
Téléphone (rés.): (514) 923-0279 (bur.): (H)		4 sessions actives (J) 0 équivalence et 0 cours échoué		
Adresse électronique :		Progression : (K) 15/114		
Citoyenneté : LIBAN				
1 Tutelle (moy. trop faible) A97-E98				
sanction (L)				
Rappel de la décision relative à votre admission : 1- ADMISSION CONDITIONNELLE A LA REUSSITE DU TEST DE FRANCAIS				
Remarques : 1- VOIR LETTRE CI-JOINTE (M)				

Figure 1. The tab « General Information » in the « Consultation » mode. (A) student code and name; (B) admission profile (if relevant); (C) list of all programs the student have been registered to; (D) status (fully active, expelled from the school, received a warning, etc.); (E) number of credits earned and registered; (F) cumulative average; (G) withdrawal percentage; (H) complete address; (I) first and last active semester, (J) number of active semesters, of correspondances and of failed

¹ A demonstration mode is also accessible to people not related directly to the University with the user name « cheminot » and the password « demo ».

² In French, these tabs are named : « Informations générales », « Cheminement comprimé », « Cheminement graphique », « Chronologie des cours » et « Évolution de la moyenne ».

³ In French, we find : « Sélection des cours », « Horaire » et « Correspondances ».

The tab « Evolution » present the evolution of the student globally semester by semester (figure 3). His average for the semester as well as the number of credits earned are presented in two columns on the left (see E) and in graphical form on the right (see F) (only semesters for which an average can be calculated⁵ are shown). If the student is in sanction or has received a warning, this information is presented as well on the graph (see D). The graph is very useful for advisors who want to have an overview of the student academic evolution.

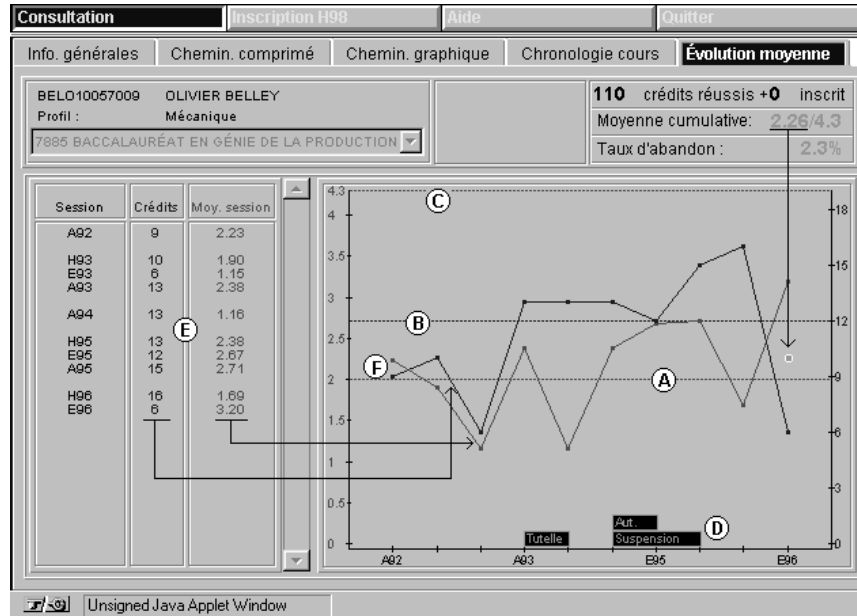


Figure 3. The tab « Evolution » in the « Consultation » mode. The (A) dotted line marks the minimum grade under which the student is falling into sanction while (B) marks the minimum number of registered credits to be considered a full time student by the government. The highest dotted line (C) marks the maximum average; it corresponds to the highest grade (A+).

The tab « Compressed curriculum » presents the proposed curriculum of the program semester by semester, for a maximum of eight semesters⁶ (see figure 4). The student is not forced to follow this sequence but he is encourage to do so.

As indicated on the illustration, the top section (A) initially presents the compulsory courses of the curriculum, the bottom section (B), courses followed outside the curriculum (ex. spanish course). The long buttons (C) identify periods of training in a company. These are not part of every curriculum and are not associated to any particular semester. The last section (D) presents the optional courses from which the student must choose in order to complete his program. Depending of the program, this section can be longer or shorter and can also appear before semester six. The courses shown in this section can change according to the option selected in (F). Note also that when such a course is followed by the student, the button associated to it moves up in the (A) section. The button (E) identifies a compulsory course that must be chosen among a fixed list.

⁵ For example a grade like S (for success) does not influence the average.

⁶ In certificate programs, the number of semesters is reduced to 4.

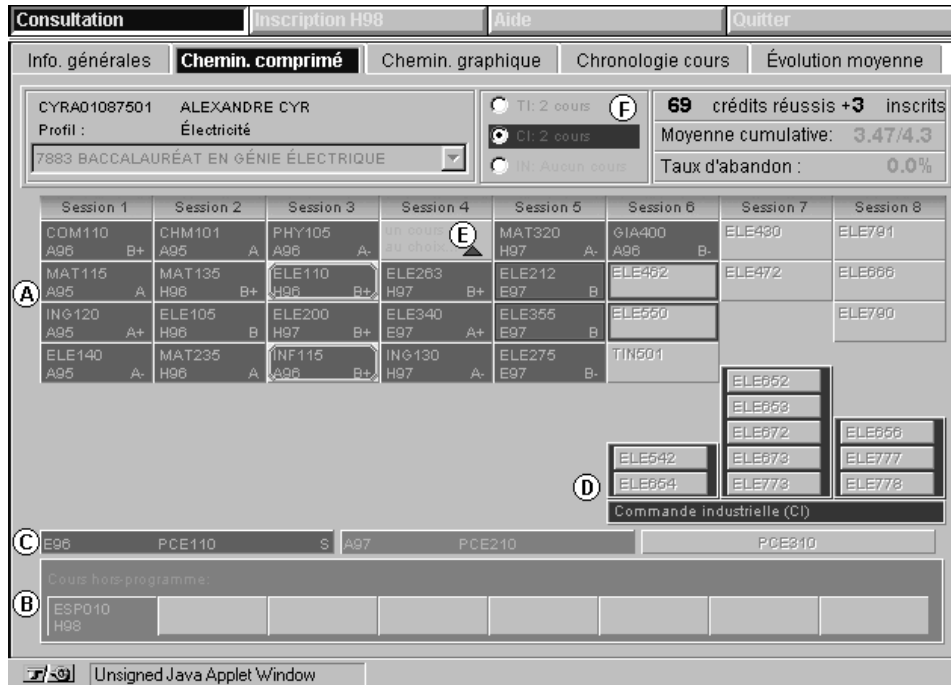


Figure 4. The tab « Compressed curriculum » in the « Consultation » mode.

The button format and the color code adopted exemplify all the particularities of the curriculum and the progress of the student within it. Figure 5, extracted from the « Help » mode associated with this tab, explains the code used.

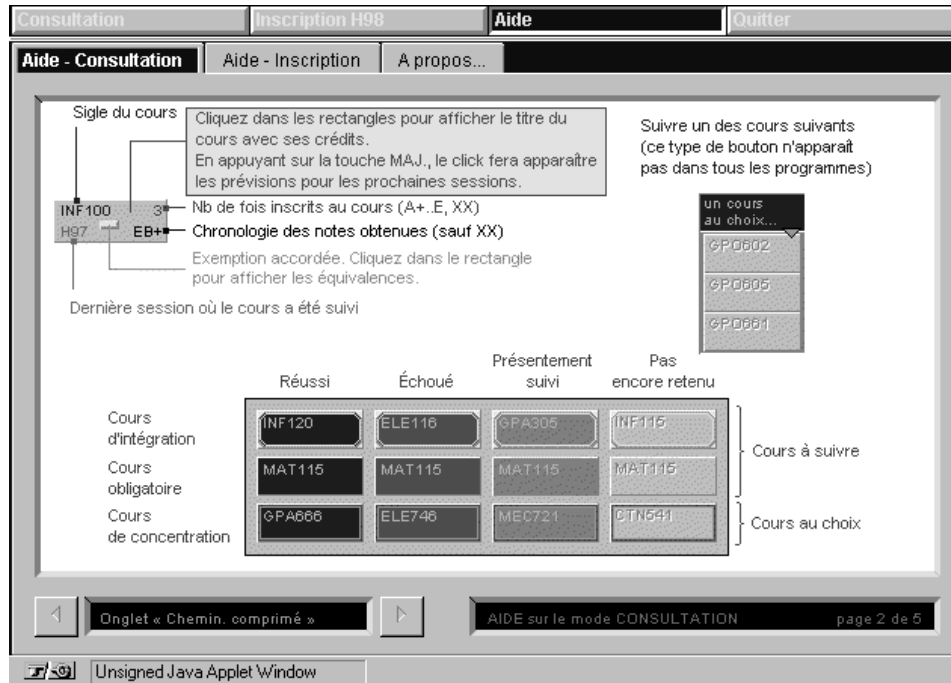


Figure 5. « Help » mode corresponding to the tab illustrated in figure 4.

As illustrated in figure 5, much information is represented by any button of the compressed curriculum tab. First, the format, polygonal framed in yellow (see INF120 in fig. 5), normal (see MAT115), or framed in color (see GPA666), corresponds to the course type, integration course, obligatory and optional respectively. Second, the background color indicates the status of that course. Blue denotes courses followed with success while red denotes failed courses. Courses currently registered have a dark gray color, while light gray buttons denotes courses that are not yet followed. Third, the button itself shows much information : the abbreviation (top left), the last semester at which the course was followed (bottom left), the list of grades obtained (bottom right), and the number of times (if greater than one) the student has been enrolled in this course. This information is again used by advisors to get a better picture of the student academic difficulties while the general picture offered by the tab shows clearly if the student respects or not the proposed curriculum (which could explain in part his difficulties).

Finally, the « Graphical curriculum » presents the proposed curriculum but this time in a graphical format (see figure 6).

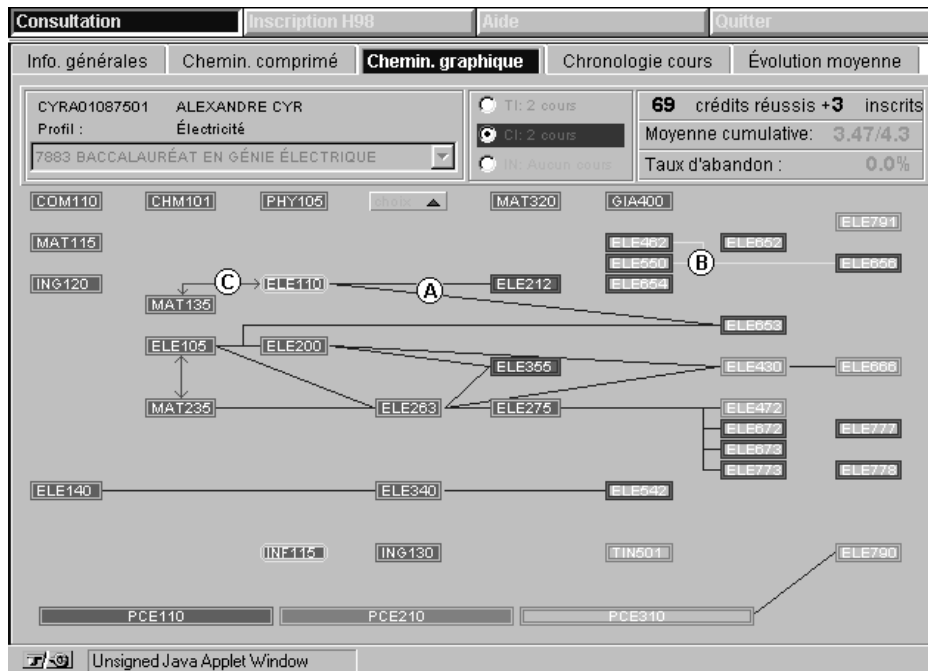


Figure 6. The « Graphical curriculum » in the « Consultation » mode.

This graphical tab presents the same color code as the preceding one but now includes the prerequisites for each course. At the moment, the system can show three types of prerequisites (for the internal syntax of prerequisites, see section 3) : obligatory drawn in blue (A), choice between prerequisites drawn in yellow (B) and prerequisites that can be followed in the same semester that the course for which they are prerequisites (the red arrow headed lines in C).

Interaction with the user. Within the last two tabs, a click on a button makes the title and the number of credits associated with the course appear in the upper right corner of

the window (figure 7a), and a shift-click makes the provisions of the course appear in the same location (7b).

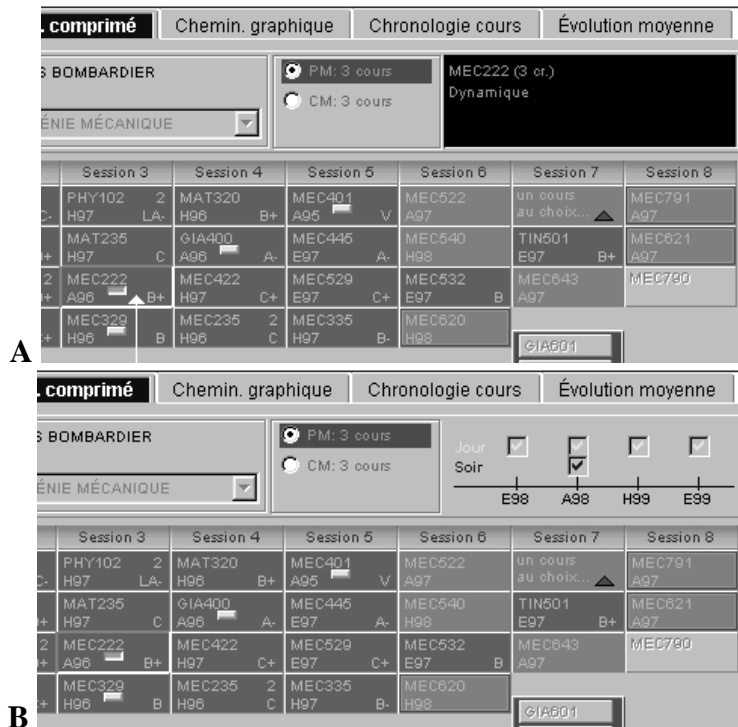


Figure 7. Showing the information on a course. Figure (a) shows the title and number of credits of MEC222 while figure (b) shows the provisions of the same course. Checkmarks indicate when the course will be offered. A blue checkmark (bottom line) indicates that the course is scheduled to be offered at night whereas a yellow one (upper line) indicates a daytime offer.

The yellow markers appearing in the center of some buttons in the « Compressed curriculum » (ex. MEC222, MEC329, GIA400 and MEC401 in figure 7) indicate that an equivalence for that course was acknowledged to the student either because he followed a similar course elsewhere or because he has already followed that course in another program in the University. These types of recognitions are called within our system : personalised equivalence (see next section). A click on a marker makes the information regarding that recognition show up in the same upper right location.

2.2 Registration mode

The tab « Choice of courses » reproduces the « Graphical curriculum » we have already seen, with two additions. First, courses offered at the next semester are always marked with a yellow diamond-shape (see figure 8, A). Second, a click on a button does not show the title of the course but can produce two possible reactions :

- 1- if the course is offered, the click is asking the system to show the student classes offered. This request can be validated by the system only if the student followed every required prerequisites for that course and if his academic situation permit him to take the course (see section 3 below).

2- if the course is not offered, a message presenting future offers for the course appears on the screen.

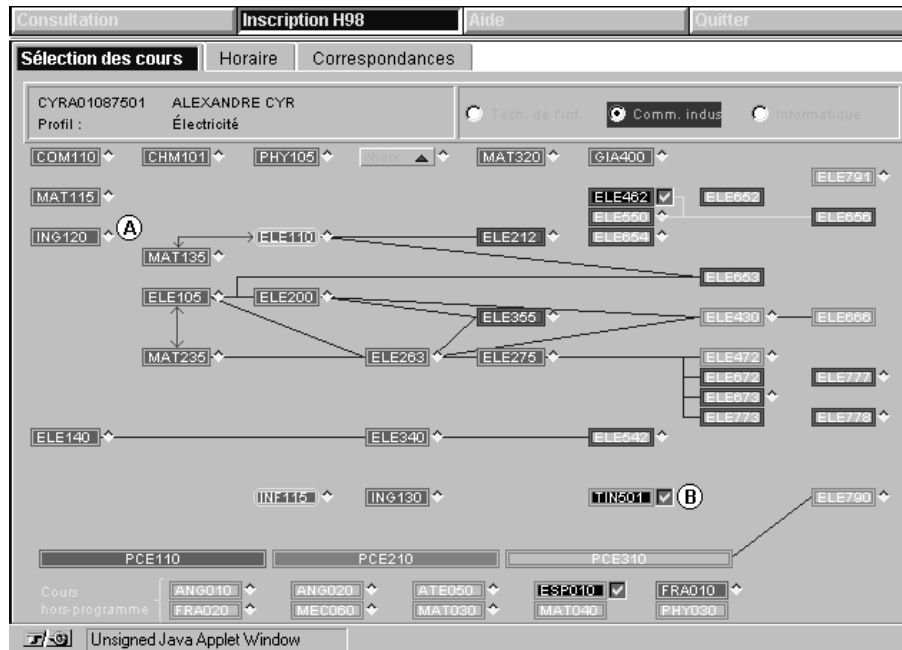


Figure 8. The tab « Choice of courses » in the « Registration » mode. Diamond shapes (A) mark courses offered while checkmarks (B) indicate courses that have already been added to the student schedule.

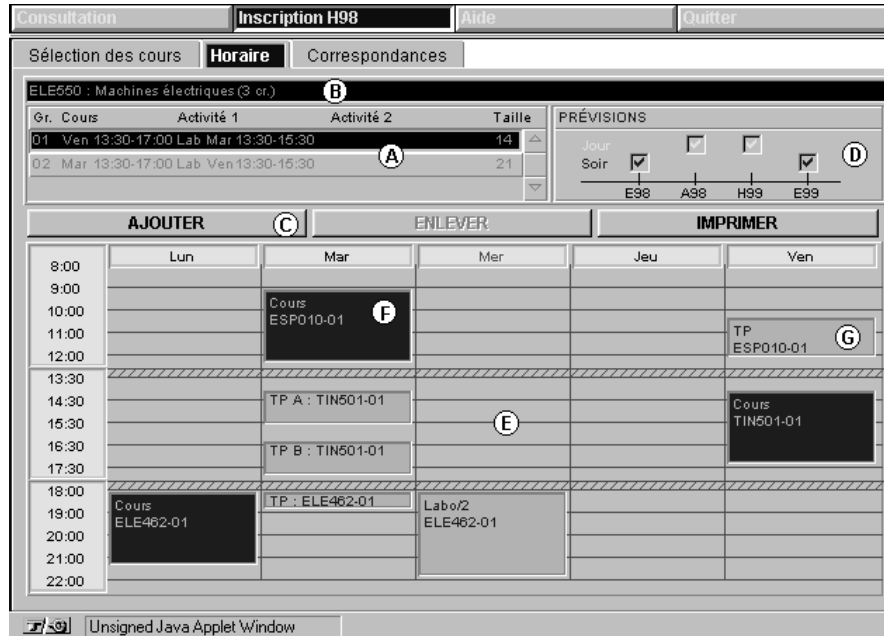


Figure 9. The tab «Schedule» in the «Registration» mode. (A) List of all classes; (B) Description of the course; (C) Buttons for adding or removing classes from the grid (E) or for printing the entire schedule; (D) Future offers of the course ; (F) Example of a main course activity and the exercice period (G) associated to it.

When the choice is validated, the system transfers the student automatically to the second tab, « Schedule », where the list of all classes is presented. Classes are always presented in size reversal order (to encourage the student to enroll into smaller groups⁷). The student chooses a class and adds it to the grid with the click of a button (figure 9).

This choice is accepted only if it does not conflict with any class already in the grid (figure 10). Although three types of exceptions are allowed by the system :

- a) conflict with an exercise period which can be split in two (these types of exercise periods are called « double activities » within the system). In that case, the system automatically removes the half that generates the conflict. For example, in figure 10, the system was able to place the exercise period (Labo) of ELE550 on top of the first half (TPA) of the exercise period of TIN501 (compare Tuesdays between figures 9 and 10). Unfortunately, the two courses (called « fixed activities », see c) below) were conflicting so the addition was not allowed by the system.
- b) conflict with an exercise period which can be taken at another period within the grid (these types of exercise periods are called « exchangeable activities » within the system). In that case the system automatically remove the period which cause the conflict leaving the other one.
- c) conflict between two exerices periods which are given every two weeks (these types of exercise periods are called « alternating activities » within the system). In that case, the system automatically operates a fusion of the two periods. For example, if the « labo/2 » of ELE462 (see C in figure 10) was conflicting with an activity of the same type, the system would allow the conflict.

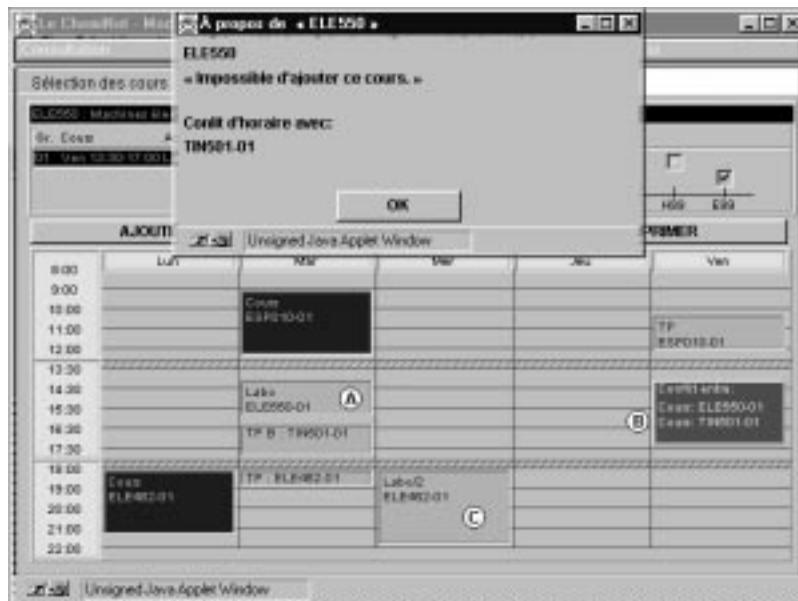


Figure 10. Retroaction to the user when an unsolvable schedule conflict occurs. The exercise period (A) was successfully added but the main course is conflicting (B) with TIN501. Conflicts are always shown in red.

⁷ This technique has proved to be very useful to equilibrate the size of classes in the first registration period we have experienced in last November.

All other activities are called « fixed activities » and cannot be subjected to splitting, removal or fusion.

This rigidity and, at the same time, flexibility of the system eliminates the need of multiple revisions by the administrative staff. In the past, students were building up their schedule very often allowing conflict between a course and an exercise periods or between two exercises periods. They were convinced that they could succeed without going to these. This state of affairs was very difficult to oppose since the staff could not possibly check every paper registration. If a university wants the maximum number of students to succeed (for various reasons⁸), this characteristic of the system (along with the fact that all prerequisites are automatically verified) is very welcomed.

Finally, the « Registration » mode presents a third and last tab called « Correspondances ». This tab is only informative. It presents in HTML table format, the historical changes that have occurred in every programs at the university. Within these tables, the older student can find out why the course he followed is now named differently in the proposed curriculum. Correspondence tables are further discussed in the next section.

3 MANAGEMENT OF INFORMATION

Upon entering the system, the user is invited to supply its user name and password. After proper validation, the system proceeds to download relevant information by mean of SQL requests to the school databases which will then be properly joined to built up the visual academic file of a specific student.

3.1 User types

A user can belong to « staff », « student » or « extern » categories and can have unlimited access or restricted access to the registration mode. With these two switches, we specified the type of user presented in Table I.

type	category	access to registration mode	comment
visitor	extern	full access (no real databases)	special user with no access to real databases and with full access to the registration mode (transactions done by this type of user are not registered by the system)
student	student	restricted access	the student has access to the registration mode only within the registration period, that is for 2 weeks) while the consultation mode is always accessible
manager	staff	no access	the manager can only consult the academic file of a student
advisor	staff	full access	advisor can access every mode at all time

Table I. Types of user accepted by the system.

Authorized staff belongs to two main types : manager and advisor. For the manager, the system does not permit any changes in the registration of the student ; only the consultation of the file is allowed. In the advisor mode, the user can modify the

⁸ Unfortunately, since a couple of years government subsidies are somewhat linked to the number of students getting a degree.

registration of the student which he can access at all time. The student is only allowed to modify its registration inside the official registration period. Furthermore, some messages and alerts are switch off if the user is an advisor (see section 4 below).

If the user belongs to the authorized staff category (manager or advisor), a search window is presented ; the user can then search the entire student database (for the moment, the system only accepts searches by student code, partial or complete).

Since advisor can modify a registration at any time and since our academic regulations specify clear deadlines for withdrawal with or without reimbursement, the system respect a calendar (downloaded at the system initialization) built up at each semester (see Table II). Within the registration period (two weeks), any change can be made. All registrations are kept in a temporary file used by the system to keep track of the student most recent schedule. The night following the end of the registration, this temporary file is joined to the main database of the school. Table II summarizes the system behaviour after this official period.

Periods	Registration period	Late registration period	Modification period (AX)	Withdrawal period (XX)	Pre-registration period
user types	student advisor	advisor	advisor	advisor	advisor
behaviour	Registered courses are kept in a temporary file which is used to update the size of each class every night. The official database is updated the night following the end of that period.	Courses removed leave no trace in the official database (updated each night).	Courses removed are automatically attributed the grade AX (withdrawal with reimbursement).	Courses removed are automatically attributed the grade XX (withdrawal without reimbursement).	Modifications are not saved.

Table II. Calendar of access and modification to the registration of a student.

3.2 SQL database requests

The downloading of information by SQL requests to databases proceed in two steps. First, information essential to the functioning of the system is downloaded. The relevant SQL requests are made when the user name and password are validated by the system. These include the downloading of five categories of information regarding courses.

- 1- The official directory description. Abbreviation, title, and number of credits for all courses are downloaded from our official courses directory.⁹
- 2- The offer. Future offers for all actual courses are dowloaded. An offer for a course is encoded with three fields : the abbreviation of the course, the semester it is scheduled to be offered and a letter that indicates either a daytime offer (between 8h and 18h) or a night offer (between 18h and 22h). Each department in our university is asked to

⁹ We are presently implementing the option of using either a full download or a selective one (that is, making an SQL request each time the abbreviation and title of a course is necessary). This option will permit the manipulation of larger directories although it will certainly slow the system.

produce these future offers once every year. These provisions covers four semesters in advance.

- 3- The schedule. Each actual class is described by all its activities (a class with three activities (the maximum) thus appears three times in the database). Each activity is given an activity type, according with the types we have already saw in section 2, and a schedule (day of the week, beginning time and duration).
- 4- The curriculum of all programs. Within our system, a course belonging to a curriculum is fully described by eight major fields : the abbreviation (ex. INF125), the course type¹⁰ and its super type¹¹, the semester in which the course should be followed (a number between one and eight), the admission profile (if relevant), the option (if relevant), the line number within the graphical presentation and the prerequisites of that course. The coding of prerequisites respects a simple logic using usual keyword (not, and, or) as well as complex selection (if.. then.. else) built upon admission profile. One special keyword, « @ », is used for « co-prerequisites » (remember the arrow headed line of figure 6) while relational symbols, « > » and « < », are used to express prerequisites that are evaluated in terms of earned credits.
- 5- The table of historical changes. Each time a program is modified, a list of abbreviation changes is produced (see table III). This list permit us to automatically make a link between an old abbreviation (ex. CHM100) and a new one (ex. CHM101). Courses that are removed and that do not have a specific equivalent in the new curriculum must be handled separately in the personalized correspondences bank.

Fall 1992	Fall 1994	Fall 1997
CHM-100	CHM-101	CHM-101
GAE-260	GIA-400	GIA-400

Table III. Sample of historical changes within a curriculum.

Next, the information regarding a specific student is downloaded. This includes : 1- personal and sociological information (address, phone number, etc.) ; 2- complete list of all programs the student have been following at the school, 3- complementary information regarding those programs (titles, total number of credits, etc.), 4- list of sanctions the student might have received (see L in figure 1), 5- complete description of the admission decision (see M in figure 1), 6- complete list of courses followed in every programs the student have been enrolled in (for each course, the information comprises the number of credits earned, the grade and the semester in which the course was followed) ; 7- list of courses to which the student is registered for the next semester (this list is of course empty at the beginning of the registration period) ; 8- the personalized correspondences bank for the student that is, the list of courses for which an equivalence was acknowledged.

¹⁰ The system can handle six course types : obligatory courses, special courses given according to a specific admission profile (these are directly related to the college formation the student received prior to his admission at the university), compulsory courses that belongs to a specific option, optional courses that belongs to a specific option, period of training and finally, optional obligatory courses (a course chosen among a list, see figure 4).

¹¹ We further distinguish between a course, a period of training and a special project.

These equivalences are used by the system to make a proper link between the actual courses¹² the student might have followed and the courses included within his curriculum. At the moment, eight type of equivalences are supported : 1- equivalence obtained prior to the admission at the school ; 2- credits integration ; 3- courses followed outside Quebec ; 4- courses followed in Quebec ; 5- equivalence obtained in a closed program; 6- courses already part of another diploma ; 7- the recognition of « n » courses for « m » courses followed ; 8- courses that do not exist anymore.

With this information in hand, the system can then proceed to construct the visual academic file of that student. First, with the help of the historical tables and the personalized correspondances, the system establishes a link between the actual academic file of the students and the courses within the curriculum. Second, the interface is built and is then ready to guide and advise the student or the staff.

4 GUIDING AND ADVISING STUDENTS

In the course of his progress and his interaction with the system, four types of messages can appear to the student : normal messages in registration mode, messages blocking the entering of the student in registration mode, messages blocking the registration to certain type of courses, and informative messages. These four message types are grouped separately in the system and can be augmented at will.¹³

4.1 Normal messages in registration mode

We have already seen in figure 10, one of the possible messages occurring in the Registration mode. The system currently includes the following messages : notification about insufficient prerequisites to take a course, notification of schedule conflicts, presentation of the previsions for a non offered course, special indications for certain types of courses (period of training and special projects), and finally, message blocking the adding of a fifth course if the student's average is too low.

Futhermore, at the entrance of the registration mode, some courses might be registered automatically without the student being able to remove them (he can of course choose another class given at a different schedule). This is actually the case with failed courses.¹⁴ The list of such forced registration is opened and can be expanded.

4.2 Blocking access to registration

Some messages inform the student that he does not have access to the registration mode. These include : average too low, student in sanction, student following a program too old to be handle (five years back), a student that did not pay his registration fees, or any academic situation which might be related to the curriculum (for example, periods of training become obligatory at some point within the curriculum of some programs). It is

¹² The number of active curriculums is thus reduced to the most recent ones.

¹³ Presently, the system handles thirty-two messages.

¹⁴ According to our academic regulations, failed courses must be taken again the following semester. This addition to the system forces the student to respect that condition and, as a consequence, assures him that his academic evolution will proceed normally.

important to note that if the blocking is due to academic difficulties (average too low), the student is referred by the system to its advisor.

4.3 Blocking registration to special courses

This group of messages informs the student on implicit prerequisites (either expressed in term of courses to take or variation on the number credits necessary¹⁵). This group thus handles the idiosyncrasies of any particular curriculum. For example, in our university, a French exam or a French course must be taken with success before being able to register to a course in oral and written engineering communication.

4.4 Informative messages

This last list of messages informs the student on specific situation. For example, at the entrance of the Consultation mode, we are showing a message to good students encouraging them to enroll into a master program at the school. At the entrance of the Registration mode, we remind relevant students of the imminent deadline of his registration to a specific training period.

5 CONCLUSION

Other registration systems already exist on the Internet (the WEB system of UQAM or Concordia University for example) but up to now, none of these is as complete as « ChemiNot ». Not only the entire academic file of the student is accessible (which is something missing in other systems) but also his progress within his curriculum is shown semester by semester. Furthermore, the graphical representation allows the student to better follow the proposed steps of his curriculum when registering to classes. Finally, the advising capacity of the system assures us that our staff can give more time to students that experience academic difficulties while being able to track them earlier.

All efforts have been made to modularize the specificity of the system. The four categories of messages are regrouped in specific parts of the program allowing the adding of new messages in an almost straightforward manner. The six types of courses (with or without an integration code or an option) cover a lot of possibilities. The only one still missing is an obligaroty choice of n courses within a list of size m (we currently have one to n) on which we are working presently.

It would be lying to say that the program can, with only minor changes (database requests), be adapted to other institutions. Although, we are confident that if both course types and prerequisite information are similar, the modularity of the system and its flexibility will assure us that the changes involved will be less demanding than building such a system from scratch.

¹⁵ For example, if a course requiring 60 earned credits will not be offered for the next two or three semesters, the system accept the registration if the student has earned 40 credits.