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Are all Chats suitable for learning purposes? A study of the required characteristics

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Abstract: The Chat is being used for more than one decade in learning environments as a useful Computer Supported Collaborative Learning (CSCL)Tool . However, nowadays some students still usually face accessibility barriers when using Chats and, as a result, they cannot learn in the same way as their classmates. Thus, some of the equality principles of education are not accomplished. This paper shows a study of chat's characteristics and analyzes if commercial Chats with general purposes can be used for learning environments in an accessible way. This study has been carried out from the point of view of the Universal Design for Learning (UDL) guidelines 2.0. The study analyzes fifteen commercial chats (desktop, mobile and web chats) and provides some recommendations in order to improve the accessibility of chats in learning environments.

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1. Introduction

Nowadays, most of e-learning systems include ways to support Computer Supported Collaborative Learning (CSCL). Some of these CSCL tools are forums, blogs, Chats and so on [1]. This research is focused on one of them: the Chat. Chat is a useful CSCL tool for students to exchange knowledge with other students or teachers [2].

There are a huge amount of Chat applications for all kind of devices. But, can we use any Chat application for learning purposes? Some previous researches have used commercial chats to learn instead of learning environments and have showed their efficacy [3], but are they accessible for all students? Previous studies have demonstrated that some people cannot access to chats due to accessibility barriers derived from technology barriers, disabilities or age [4] and, moreover, software developers do not always know how to make their programs accessible to everybody or even they do not know about these accessibility barriers.

Taking into account these questions, the research work presented in this paper aims to detect which are the characteristics that Chats should have to be accessible learning tools. Moreover, the study aims to check if generic Chats can be used in learning environments in an accessible way, according to the Universal Design Learning (UDL) principles [5]. Thus, fifteen commercial Chat applications have been analyzed to assure if they could be used as accessible learning tools, accomplishing the UDL guidelines. Then, some recommendations are provided in order to improve the accessibility of chats from the point of view of the UDL guidelines.

2. State of art

2.1. Accessibility: Laws and Guidelines

Different laws around the world protect the human's rights of people with disabilities or special needs because the access to pedagogical resources and learning tools should be assured for every student. Some examples are the Sections 504 and 508[6] in USA, the Disability Act 2005 in Ireland [7] or the Equality Act 2010 in the UK [8].

Moreover, there are some standards and guidelines which help to protect these rights and some of them are specific for learning environments. IMS Global Learning Consortium provides standards to create accessible learning environments such as: Access for All Meta-data [9] which is now an ISO specification (ISO/IEC 24751 [10]) or IMS Guidelines for Developing Accessible Learning Applications [11]. The guidelines provided by the National Center on Universal Design for Learning are also consolidated. Specifically, the UDL v2.0 guidelines [5] are created to reduce barriers to access the learning content and the study of this paper is based on them.

2.2. Use of Commercial Chats as Learning Tools in Learning Environments

Some previous pedagogical studies have demonstrated the efficacy of commercial Chat applications as learning tools. This application is useful for CSCL purposes and students and teachers can communicate with each other easily. Specifically, a study, related to the use of social networks for learning, observed that some teachers and students use social networks as Facebook to exchange knowledge. Moreover, they usually do it through Chats with their virtual colleges [12]. Besides, other studies have demonstrated that commercial chats like Skype or Google Chat can be used in learning environments to learn [13].

Previous studies were focused on desktop or web Chats, but other studies were focused on Chats in m-learning environments. For instance, the study [14] establishes that any chat could be used as a m-learning tool. The study [3] specifies how students interact with some commercial Chats to learn and concludes that students usually prefer mobile Chat applications instead of Chats in social networks for learning. Besides, the study [15] shows that most of students prefer to use Whatsapp[2] instead of the Blackboard[3] learning environment for CSCL.

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[2] http://www.whatsapp.com/
[3] http://www.blackboard.com

2.3. The Chat's Accessibility Problems

Thanks to advances in technology during the last decade, Chats have been improved from the point of view of their designs, features and social acceptance. However, despite of these advances; chats still present serious accessibility barriers for many users. Next, some examples of typical accessibility barriers are exposed.

Related to the flow and rhythm of the conversation, some people could face problems if he has problems such as: he is not able to write quickly or he has cognitive or learning disabilities, etc. [16]. Other problem is related to the use of assistive technologies. Screen reader restarts reading the whole page again when new content appears, instead of reading only the new content [17]. Moreover, the use of AJAX technology in live regions could cause problems when it is not tagged properly [18]. Furthermore, there are problems related to the technology used. For example, developers do not use CSS appropriately or they use Flash, Java or Javascript improperly [19][20].

3. Chats' Features to be Accessible Learning Environments Basing on UDL Guidelines

This section specifies the main commercial Chats' features need basing on UDL guidelines. These guidelines specify what characteristics should have learning environments to provide equal opportunities for all students. UDL guidelines are divided into three principles: I. Provide Multiple Means of Representation; II. Provide Multiple Means of Action and Expression; and III. Provide Multiple Means of Engagement. Moreover, each principle is divided into other guidelines which will be considered in the study process. However, it is important to emphasize that the chat is used as a CSCL tool to exchange knowledge and is not a tool to evaluate the progress of learning in this study; thus, some guidelines are not applied in the experiment. Two different accessibility experts in learning environments have studied in parallel how to apply the UDL guidelines to assure if a commercial Chat tool could be used to learn and which guidelines should be applied or not. For instance, the checkpoint *6.4 Enhance capacity for monitoring progres*s is not considered because we consider that the Chat is not initially intended to evaluate learning progress. Furthermore, guidelines related to how the content must be organized are not taken into account because teachers cannot manage the content as they do not lead the way of learning. Thus, the checkpoint *5.3 Build fluencies with graduated levels of support for practice and performance* is not considered.

Basing on the UDL guidelines and taking into account just the selected guidelines, the main features to take into account in this study are collected and grouped in different categories related to events and functionalities inherent to commercial Chats. These categories are: A) Sent and received text messages, B) Audible alerts, C) Visual alerts, D) Sent and received multimedia files, E) Interface, F) Conversation history, G) Information about user's state, and H) Group conversations. Besides, each of these categories is subdivided into other functionalities which are more explicit and makes reference to UDL guidelines. These sub-categories have been summarized in Table 1. By checking the compliance with these features, accessibility barriers in learning environments can be detected.

4. Chat's compliance with the Universal Design for Learning guidelines

This section shows how the experiment has been carried out to check if Chats applications for general purposes could be used for CSCL by everybody.

4.1. Study Design

Fifteen Chats have been selected based upon different criteria explained in section 4.1.1. Next, the features summarized in Table 1 are checked for each Chat, analyzing its compliance with the UDL guidelines in a specific technological environment. Next, each step of the study is specified in detail.

4.1.1. Chats Applications in the Study.

The selection criteria of the commercial chats for the study are next: percentage of use of the chat; if the chat can be executed in different platforms and devices; and finally if the Chat has been previously used for learning.

Some Chats applications are available for more than one platform/device and this characteristic is desirable for the study to check if all versions present the same features or not and if it could be more suitable for CSCL.

Table 1. Chat's Features related to UDL guidelines. Check List.

Classification	Code	Description	UDL
A. Sent and received text messages.	A1	Change the size of sent text	1.1 / 7.1
	A2	Change the size of received text	1.1 / 7.1
	A3	Text color change	1.1 / 7.1
	A4	Font change	1.1 / 7.1
B. Audio alerts	B1	Chance to mute the entire audio alert	1.2 / 7.1
	B2	Chance to change a warning sound	1.2 / 7.1
	B3	Possibility to customize alerts sounds per user	1.2 / 7.1
C. Visual alerts	C1	Existence of visual alerts with text	1.3
	C2	Visual alerts can be blocked/disabled	1.3 / 7.1
	C3	Visual notifications with number of pending messages	1.3
	C4	Visual notifications when send/read messages	1.3
	C5	Advertisements are not showed	7.3
D. Sent and received multimedia files	D1	Send and receive files is allowed	5.1
	D2	Sending a file let add descriptive alternative text	2.5
	D3	Send and receive files can be blocked/disabled	1.1
E. Interface	E1	Used icons are intuitive and have alternative text.	2.1
	E2	Navigation through the window with assistive tools.	4.2
	E3	Changing interface elements (background)	1.1/7.1
F. Conversation history	F1	Navigation through a conversation.	3.3
	F2	Searching a text in a conversation.	3.3
	F3	Removing a conversation history	3.3
	F4	Save/Download a conversation history	3.3
	F5	Delete local messages from a chat.	3.3
	F6	Editing messages	3.3
	F7	Different navigations (Using gestures on touch screens/trackpads, access through keyboard, mouse…).	4.1
G. Information about users' state	G1	Information about user connectivity status (Online/Offline)	8.3
	G2	Information about user availability (Available/Busy/Away)	8.3
	G3	Modification of the availability status message	7.1/1.1
	G4	User information within the conversation (Writing…)	8.3
H. Group Conversations	H1	Silence groups for defined periods of time	1.2
	H2	Allow viewing history conversation to new members	3.1
	H3	Clear differentiation between members (color/image/text)	1.3
	H4	Color contrast between users	1.3

After the consideration of all these criteria, the Chats specified in the Table2 have been selected for this research as well as the Chat version and the platforms or devices where they were executed for the study.

Table 2. Selected chats for the study classified according to the platform/device

Chat ID and Chat Name	Type of application	Version
1. Facebook web chat[4]	Web application	June, 1st 2013 (Last Checked)
2. Gmail Web Chat[5]	Web application	June, 1st 2013 (Last Checked)
3. PARAChat Web Chat[6]	Web application	June, 1st 2013 (Last Checked)
4. ATutor[7][11]	Web application	June, 1st 2013 (Last Checked)
5. Facebook for Windows[8]	PC application	v. 1.2.205
6. Google talk for Windows[9]	PC application	Release version November, 21st 2007
7. LINE for Windows[10]	PC application	v. 3.1.7.10
8. Skype for Windows[11]	PC application	v. 6.3.107
9. Facebook App[12]	iOS application	v. 2.4
10. Google Hangout App [13]	iOS application	v. 1.0.1
11. WhatsApp Messenger[14]	iOS application	v. 2.8.7
12. LINE Naver[15]	iOS application	v. 3.6.5
13. Skype App[16]	iOS application	v. 4.8.234
14. Viber App[17]	iOS application	v. 3.0.0.4074
15. SpotBros App[18]	iOS application	v. 2.6

4.1.2. Study's Environment

Each chat was executed in a different environment depending on the platform. Web and desktop applications are evaluated in Windows Operating System (Windows 7 SP1[19]). Moreover, the web applications have been analyzed with the Google Chrome web browser (Google Chrome Version 27.0.1453.110[20]). Finally, mobile applications were evaluated in the Apple Operating System, iOS with the iPhone 4S (iOS version 6.1.1.10B145)[21].

4.2. Results Derived from the Study.

Table 3, which is showed in the Annex section, summarizes the study results but the whole results can be read in the website labda.inf.uc3m.es/ChatsEvaluation[22] . Next, some findings are underlined and described in detail.

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[4] http://www.facebook.com/

[5] http://www.gmail.com/

[6] http://www.parachat.com/

[7] http://atutor.ca/achat/demo/new_user.php

[8] https://www.facebook.com/about/messenger

[9] http://www.google.es/talk/intl/es/

[10] http://line.naver.jp/en/

[11] http://www.skype.com/es/download-skype/skype-for-computer/

[12] https://itunes.apple.com/es/app/facebook/id284882215?mt=8

[13] https://itunes.apple.com/es/app/hangouts/id643496868?mt=8

[14] https://itunes.apple.com/es/app/whatsapp-messenger/id310633997?mt=8

[15] https://itunes.apple.com/es/app/line/id443904275?mt=8

[16] https://itunes.apple.com/es/app/skype/id304878510?mt=8

[17] https://itunes.apple.com/es/app/viber-free-phone-calls-text/id382617920?mt=8

[18] https://itunes.apple.com/es/app/spotbros/id555289742?mt=8

[19] http://windows.microsoft.com/es-es/windows7/whats-included-in-windows-7-service-pack-1-sp1

[20] https://www.google.com/intl/es/chrome/browser/features.html

[21] http://www.apple.com/es/iphone/iphone-4s/specs.html

[22] Password: UC3M2013

From the point of view of the *A* group of characteristics (*related to "sent and received text"*), users of Chats applications like Parachat, Google Talk, Line and Skype allow increasing the size of the sent text messages. In contrast, the other Chats studied do not allow controlling it (related to **A1** checklist). Moreover, these Chats applications and Whatsapp and Spotbros also allow users to increase the size of the received text (**A2**) and to change the font type (**A4**). However, only Parachat allows users to change the font color (**A3**). Figure 1 shows this accessibility barrier in Whatsapp. When a user tries to change the size of the text, the text size of send messages can be changed but not the text that the user types.

Fig. 1. Increasing text size in Whatsapp it is only available to sent and received text, not written one.

Regarding the *B* group of characteristics, users of all Chats except Hangout and Viber have the chance of muting the entire audio alerts, for instance, when a new text is received in a chat (**B1**). On the other hand, only Whatsapp, Line and SpotBros allow users to change the sound of the audio alerts, similar for all individual or group chats (**B2**). Finally, only Whatsapp have the possibility to customize sound alerts per user or group (**B3**).

Related to *C* group of characteristics, all analyzed chats have some type of visual alerts (**C1**), but not all of them allow users to block them (**C2**). Examples of applications which do not allow blocking alerts are the web chat of Facebook, Facebook messenger or Hangouts. On the other hand, all the analyzed chats notify the number of pending messages (**C3**), but only some of them include notifications when a message is sent and/or read: Whatsapp, Viber, Spotbros and Line in both, PC and iOS version. Finally, none of the evaluated chats show advertisings in any window (**C4**).

From the point of view of sending and receiving files (*D group*), each analyzed Chat allows users to send and receive files (**D1**) but none of them do it in an accessible way. It means that they do not allow users to add alternative descriptive text for files (**D2**) and do not allow users to block this functionality to avoid this accessibility barrier (**D3**). Thus, there is not an option to disable the reception or sent of files.

On the other hand, the interface of a software product is really important in the way the user interacts with the system because it is the only method by which users can interact with the device, and allow communication as easy and intuitive as possible, and so on; it is crucial to allow all users to have equal opportunities of interaction. Therefore, related to the *E* group*, the first checkpoint analyzed is, if the icons and/or images used in the interface are intuitive and all of them have alternative content (**E1**). All the analyzed chats have alternative text when users rollover the icon. Another useful feature, which does not many chats include, is the support for the use of assistive tools (**E2**). Only Line for Windows and Skype for Windows provide it. Finally, the background of the chat (**E3**) can be changed in Whatsapp, Line, Viber and SpotBros.

The next sets of features analyzed are those related to the conversation history (F group). All chats include a conversation history which can be temporary or not. All of the analyzed chats allow saving the conversation history; however, if some options aren't enabled for users, there are some accessibility barriers. For example, the impossibility of navigating through previous conversations could disturb users because they do not know the context of the conversation (**F1**). Besides, it could be really important for users, and specifically for students, to search a specific text in a conversation (**F2**); but Whatsapp allows doing it. Other chats like Google, which stores conversations in the Mail User Agent and the website, can search only for chats, but the user has to search on the messages storage instead on the conversation history. Furthermore, if users want to delete the chat history (**F3**), some chats do not provide this functionality or they do it, but not in an accessible way. Good examples of this functionality are Whatsapp, Line, Viber and Spotbros, which allow doing it in an accessible way. Other chats like

Google or Facebook (all versions) allow deleting the content of the chat windows, but the conversation is still stored and users can only delete it on other web sections. Other functionality, that not many chats include, is to save or download a conversation (**F4**). Whatsapp, Line in both analyzed versions, Viber and Spotbros allow doing it. Moreover, only Whatsapp allows deleting local messages from a conversation (**F5**). Finally the last two functionalities relative to conversation history are: editing messages (**F6**) supported exclusively by Whatsapp, and the use of gestures on touch screens or trackpads (**F7**) which none of the analyzed chats implement.

With regard to the G group of characteristics, knowing the status of users to initiate a real-time conversation is crucial. To establish a synchronous Chat, it is necessary to know if the person is available or connected. There are different accessibility barriers regarding the status of the users. The first one is if users have information about other people connectivity status (online/offline) (**G1**). Many chats include this functionality but Line and Spotbros do not show information about user status. When users are connected to the chat system, it is interesting to know if people are available or not (**G2**). Gmail, Parachat, Google Talk, Skype, Whatsapp and Line show the users' availability. Moreover, it is interesting to allow users to change the availability status (**G3**) adding some information text. Gmail, Google talk, Line, Whatsapp and Spotbros provide this feature. Finally, information related to the situation of other users (writing, typing text, etc.) (**G4**) is only provided in Gmail, Parachat, Google talk and Whatsapp.

The last group (*H*) is related to conversations with multiple users (group conversations). There are some accessibility barriers such as: silencing groups for periods of time (**H1**) which is provided by Whatsapp, Line and Hangouts exclusively as seen in Figure 2; viewing history conversations to new members (**H2**) which is not provided by any chat; establishing a clear differentiation between members of the group (**H3**), where Atutor and Skype (in Windows version) fail because they do not show easily differentiation methods between users (by text, images or colors), resulting difficult to distinguish between chat participants.

Finally and using a color contrast checker tool provided by WebAim[23] and color selectors[24], the contrast between users (**H4**) have been checked. Only in Whatsapp and Skype the results have been negative because there are some colors without a minimum contrast.

Fig. 2 Silencing groups for different periods of time in (from left to right): Whatsapp, Line and Hangouts.

5. Recommendations

Considering the obtained results, we can conclude that none of the analyzed Chats accomplish with all the detected features necessary to be accessible for learning environments. Therefore, a set of recommendations has been elaborated in order to improve the commercial Chats if they were wanted to be used as accessible CSCL tools. A summary of these recommendations is listed next:

[23] http://webaim.org/resources/contrastchecker/
[24] http://www.martinstoeckli.ch/colorbug/colorbug.html

- **Text Configuration (1.1 and 7.1 guidelines):** Chats should allow users to change the size and type of fonts or colors to improve the accessibility because the standard size or color may not be adequate for all people.
- **Visual alerts (1.3 and 7.1 guidelines):** Chats should have options to change or disable those elements that may not be accessible for all. For instance, when new events appear like new messages, users should be able to avoid the use of flashing windows, pop-ups or even, invasive notifications. Moreover, chats should provide information about the state of the sending and receiving message process (when the message has been delivered, read or if any other problem had happened).
- **Users' names Configuration (1.1 and 7.1 guidelines):** this feature is really useful for people who use screen readers because they could change their friends' nicknames to avoid large or names as well as nicknames with emoticons in the list of available/unavailable users.
- **Spelling Checker (5.2 guideline):** chats should include a feature to detect the spelling mistakes and it should not be dependent on the operating system where it is running.
- **Text-to-speech (5.2 guideline):** there are some devices which support text-to-speech, but there are other devices which do not allow doing it. Thus, Chats should provide a way to transform the text-to-speech just in case the device does not have this new functionality.
- **Sending files (1.1 and 7.1 guidelines):** the major problem when sending files in Chats is that, due to internal behavior, they change the files' name. It is a barrier because many of these files contain unusual characters that cannot be processed by assistive tools. Thus, there should be an option to add a file name.
- **Interface content (2.1 guideline):** all elements in the interface of a Chat should have alternative texts and even the option to change the way those elements are presented. For example, users should have the option to select if they prefer view other users profile picture or only texts. If some of these features are allowed, the accessibility of the chat should increase.
- **Glossary (6.3 guidelines):** students could not know all the terms in each lesson. Thus, it should be necessary to provide a glossary with the new terms which are learnt in the course.
- **Create collaborative groups (8.3 guideline):** create learning groups in classes for pedagogical reasons in order to potentiate CSCL learning; thus, it should be created a chat group per learning group.
- **Avoid distractions (7.3 guideline):** publicity or unimportant information, for instance, could distract the students during their learning process. Chats should avoid this kind of distractions.
- **Include assistive tools (4.2 guideline):** Chats should add options for a better integration of assistive tools used mainly by people with disabilities. For instance, automatic readers, high contrast visual options or even voice dictation should be integrated in the application in order to improve the Chat's accessibility.

6. Conclusions and Future Work

The study presented in this paper allows us to collect the main features that fifteen commercial Chats have and if they could be used in learning environments basing on the UDL guidelines.

The main characteristics that a Chat for learning environments should have basing on the UDL guidelines have been collected. Then, these characteristics have been considered to analyze the selected commercial chats. After analyzing all the commercial applications from the point of view of UDL guidelines, the Chats which better fit to learning environments are Whatsapp and Parachat. Moreover, this study have detected that there are some chats which should not be used in learning environments like Facebook or Hangouts because they present important accessibility barriers. On the other hand, this study shows that some chats provide improvements related to accessibility. Specifically, chats such as: Whatsapp, Line or Parachat have some accessibility features that allow a better use of the chat for people with disabilities. For instance, Parachat improves the space between lines adding a double space, the selection of the technology on which run the chat for trying to reach more people or a customization on the message format allowing to include time. Furthermore, Whatsapp allows blocking private windows and Parachat allows personalizing the format of the received and sent messages.

Finally, some general recommendations for being more accessible chats in learning environments have been specified. Some of these recommendations are related to provide ways of personalization, configuration or improve the learning experience.

As future work, a complete accessibility evaluation of those chats, which seemed more accessible in learning environments, will be carried out. This accessibility evaluation will be based on the ISO/IEC 40500:2012 Information technology -- W3C Web Content Accessibility Guidelines (WCAG) 2.0 [21], Mobile Web Best Practices 1.0[22] and/or ISO 9241-171 [23] depending on the environment (desktop or mobile) that we will aim to evaluate. After that, basing on the obtained results, a guideline will be elaborated to specify the best practices to make an accessible chat for learning purposes.

Acknowledgements

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7. Annex

Table 3 included in this Annex specifies the results obtained after analyzing the main Chat's characteristics which are specified previously in the Table 2. This table shows the code of each checked characteristic showed in Table 2 as well as it is accomplished by each analyzed chat which is named with the code assigned in the Table 1.

Table 3. Summary of the evaluation results

Evaluation Point\Chat ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A1			✓			✓	✓	✓							
A2			✓			✓	✓	✓			✓	✓			✓
A3			✓												
A4			✓			✓	✓	✓			✓				✓
B1	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
B2											✓	✓			✓
B3											✓				
C1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C2		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓
C3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C4							✓				✓	✓		✓	✓
C5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
D1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
D2															
D3															
E1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
E2						✓	✓	✓	✓		✓	✓	✓	✓	✓
E3											✓	✓		✓	✓
F1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F2											✓				
F3											✓	✓		✓	✓
F4							✓				✓	✓		✓	✓
F5											✓				
F6											✓				
F7															
G1	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	
G2		✓	✓			✓	✓	✓			✓	✓	✓		
G3		✓				✓					✓		✓		✓
G4		✓	✓			✓					✓				
H1							✓			✓	✓	✓			
H2															
H3	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓
H4	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓