Editorial

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Welcome to the Bulletin of the IEEE Technical Committee on Learning Technology, Volume 19, Number 1 issue.

The Bulletin of the Technical Committee on Learning Technology (TCLT) aims at publishing and disseminating current research about new and emerging learning technologies as well as their design, usage, application, and evaluation in different contexts of technology enhanced learning.

The special theme of this issue focuses on topics related to technology enhanced language learning, including (but not limited to) research on concepts and design of systems and technology that supports language learning; practical applications of technology enhanced language learning; case studies, exploratory studies and pilot studies that utilize technology to teach and learn languages; and evaluations and assessments of technology, systems, and tools that support language learning.

First of all, Omarali conducts an exploratory review elaborates on how discussion boards on the Internet are used for teaching English and how they empower students through a socioconstructivist and collaborative approach towards composition writing. Lopez, Luce, Zapata-Rivera and Forsyth in the second article discuss the use of prototype formative conversation-based assessments designed to measure English learners' language skills. Jackson, Inglese, Wain, Timpe-Laughlin, and Grace further describes efforts related to the evaluation of a game-based assessment called "Awkward Annie" which targets English language pragmatics by having players intentionally select the most awkward responses. At the end, Ebner, Ebner and Edtstadler argue the personal digital devices are offering new ways of engaging students in language learning in schools and at home. They offer individualized feedback during the process of writing with learning analytics methods to support the students' autonomous learning.

Besides the three articles for the special theme, this issue also includes two regular articles. Kumar describes the design and evaluation of an online software, CmapEditor, for interactive concept mapping developed by using Java Servlet Pages (JSP), Java Script and Java Script Object Notation (JSON). Kardan and Kazemi-Arani reveal the details of gamifying online exams with the game elements include rewards, trophies and leaderboard.

We hope that the issue will help in keeping you abreast of the current research and developments in Learning Technology. We also would like to take the opportunity to invite you to contribute your own work (e.g. work in progress, project reports, dissertation abstracts, case studies, event announcements) in this Bulletin, if you are involved in research and/or implementation of any aspect of advanced learning technology.

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A Review on Using Internet Discussion Boards to Supplement Collaboration in English Language Composition Writing

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***Abstract*—With the imminent role of ICT in education, schools are taking imperative measures to educate its learners by means of new technologies. This exploratory review elaborates on how existing computer facilities are being utilised to teach English, in particular the area of composition writing, to a class of Bruneian students where English is both a subject and a foreign language. This article focuses on the technology of Internet discussion boards and how they empower students through a socioconstructivist and collaborative approach towards composition writing.**

***Index Terms*—collaborative writing, computer assisted classroom discussion, computer mediated communication.**

I. Introduction

The 'model class' portrayed in this review is a representative of a common upper secondary level class in any school in Brunei. The average number of students is 20 and their capacity in English is average [1]. The students have adequate computer skills as a result of their ICT learning experiences in primary school level [2] as well as external exposures based on using computers at home. These students are purportedly 'Millenials', meaning that they are born as 'native' users of digital technology [3][4].

English language teachers for the secondary level usually abide to a set curriculum, syllabus and government issued textbooks. However teachers are able to deviate from this convention and are encouraged to exploit other resources that befit their students. The use of computers is greatly supported to the extent that English Language teachers are always prioritised to utilise them.

One area of concern for English teachers is composition writing. Brunei Darussalam ultimately assesses its students using the Cambridge GCE 'O' Level Examinations. Composition writing carries the bulk of the qualitative marks and thus this task is a common challenge for students, as it tends to focus on both accuracy and creativity. Teaching composition writing to students involves time-consuming rituals of classroom discussions, writing drafts, individual consultations, and proofreading and editing in phases.

The primary objective of using Internet discussion boards is to provide a medium where students can communicatively collaborate by discussing ideas for writing and peer proofreading. Hitherto it is anticipated that less classroom time would be exhausted and more opportunities to communicate could be gained through posting comments and real-time chat beyond the temporal and spatial boundaries of a classroom. Discussion boards are a medium of both Synchronous and Asynchronous Computer Mediated Communication and as such the discourse of this review revolved around these communicative features of online discussion boards.

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II. Literature Review

A. Conceptualising Computer Mediated Communication

This review focuses mainly on elaborating and exemplifying text-based Computer Mediated Communication (CMC) and its sub variants, viz. 'one-to-one', 'many-to-many', 'synchronous' and 'asynchronous'. CMC in relation to online discussion boards can be reviewed through the conceptualisations of Computer Assisted Classroom Discussion [5] and Asynchronous Computer Conferencing [6]. Furthermore, due to the similarity of 'CMC *in* collaborative learning' and 'Computer Mediated Collaborative Learning', the two terms are used interchangeably.

Computer Mediated Communication (CMC) is a term to define communication that uses computers which involves among others, e-mails, chatting, forum boards and video-conferencing [5], [6]. Educationists identified these methods of communication as potentially useful to learning thus consequently integrating CMC in teaching and learning.

English learning benefits from CMC because it "provides opportunities for language learners to practice their language" [7]. CMC is also perceived as a "possible cognitive amplifier that can encourage both reflection and interaction" [8] and as a bridge that connects speech and writing allowing both reflection and interaction to take place in one medium [9]. In addition, Computer Conferencing has been defined as "a group communications medium enabling groups of people to exchange ideas and opinions and to share information and resources." [10].

The keywords that could be extracted from the last paragraph are 'medium', 'interaction' and 'reflection'. 'Medium' in this case exists as a virtual classroom environment where students have opportunities to learn and be taught together; 'interaction' as a means to communicate among students and between students and teacher(s), and 'reflection' as the facility to revisit what has been interacted through the medium. Hence, compared to the ephemeral properties of unrecorded spontaneous speech in onsite classroom discussions, the discussion board medium has the useful attribute of retaining all text-based communication that in turn encourages students' reflexivity.

To successfully implement CMC into learning, the 'medium' of choice should cater effectively to the needs of reflection and interaction where optimal collaboration can take place and very little of the social dynamics of the classroom is lost. In essence,

discussion boards "allow (idea) exchanges or quick questions and answers" and "combine almost real-time capabilities with the flexibility and potential depth of asynchronous communication" [11]. For these reasons, discussion boards can become a virtual classroom where it can adapt and build upon the social dynamics of the onsite classroom. Fittingly, the term Computer Assisted Classroom Discussion encompasses learning that transpires and is negotiated through both the onsite classroom and the virtual Internet classroom [3].

In composition writing tasks, students are usually encouraged to collaborate during the early stages of the syllabus to provide them initial scaffolding, particularly when the task at hand is challenging. Collaborative learning has been described as situations where students interact to produce a joint solution to some problem [12]. In the case of using a discussion board to collaboratively complete composition writing, students are able to assist one another through constantly providing peer feedback to each individual's writing process.

Peer feedback is a fundamental aspect of computer assisted collaborative learning. It allows for the formative assessment of work in progress [13], including private feedback from peers [14] and the construction of knowledge through a system of commendations and criticisms [15], provided that that peer feedback is of good quality and not misleading [13]. These affordances contribute to the collaborative environment of discussion boards.

In Brunei classrooms, students are accustomed to collaborative learning in composition writing as it is the norm of approaching the task. The task itself comprises of several stages of writing. Rather than having students undergo the stages individually, students attempt the task in groups because "there is evidence that in the discourse in which learners articulate and share their understandings, there is potential for sharing the cognitive load of the learning task" [12], When CMC is involved in these stages, collaborative learning can lead to learning outcomes comparable with those achieved in face-to-face classes [16].

Computer Mediated Collaborative Learning enables collaboration via five principles [9] that, if present in the classroom, are improved further by CMC; and if absent from the classroom, are uniquely provided by CMC. The five principles are "(1) text-based computer mediated communication, (2) many-to-many communication, (3) time- and place-independence, (4) long-distance exchanges, and (5) hypermedia links" [9]. Apart from principle (2), which can occur in onsite classrooms, the other principles can be regarded as unique to CMC.

Text-based computer mediated communication is a combination of both writing and speech. Text-based CMC enables the student to both communicate and reflect on what has been communicated. Further reflection allows quick editing and evaluation while in communication [9]. Hence, text-based CMC is regarded as the fourth evolution of human communication and cognition after 'language', 'writing' and 'print' [17]. The affordances of text-based discussion therefore enhance interaction among students in writing activities [14]. In an online discussion board setting, a student can interact with other students or a teacher while simultaneously reflecting upon the discussion at hand. Many-to-many interaction and reflection can occur simultaneously provided that time is given to reflect on the many-to-may interaction.

Therefore, a functional characteristic of the discussion board is its capacity to allow many-to-many communication without fail. A reliable discussion board provides enough individual space for each student in addition to providing pockets of opportunities where students can seek help from peers or the teacher(s) [18]. Since this principle exists in the traditional classroom it can be argued that supplement lessons with CMC would result in an insignificant improvement. On the contrary, many-to-many CMC permits students to discuss while simultaneously have the content of their discussions retained in text form allowing for constant and repetitive reflection [9].

Furthermore, past studies concluded that many-to-many CMC has its own social dynamics that actually promotes equality in participation as compared to face-to-face discussions where more often than not introverted students are left out [9]. One experimental study found that CMC creates "an intellectual environment that encourages active, thoughtful, and equal participation from all comers" [19].

The constraint of time is of a lesser concern with Computer Mediated Collaborative Learning compared to onsite classroom. The Internet enables constant access to the discussion board. This in turn allows students to work at their own pace as well as in their own time compared to the group work in the classroom where spatial and temporal constraints are determined by the school. Through Internet discussion boards, students and teachers can therefore interact outside of the classroom and prepare their compositions when they see fit [9].

The last two principles, viz. 'long-distance exchanges' and 'hypermedia links' are not as significant as the previous principles. The longest distance a student would experience would be the distance from the school to home. Hypermedia links are indeed useful in online learning but with regards to composition writing the most a student or a teacher can do is to provide links to resources and ideas that relate to the composition topic, including the sharing of useful online tools such as digital dictionaries [18].

The principles of Computer Mediated Collaborative Learning defined CMC as an empowering supplement for composition writing task. CMC enables students "to share not only brief messages, but also lengthy (formatted or unformatted) documents - thus facilitating collaborative writing" [20]. In addition, students "can also use the Web to publish their texts or multimedia materials to share with partner classes" [20]. In consideration of the above, CMC is a potentially effective medium for collaborative learning.

B. CMC and Collaborative Composition Writing

Word-processing is a powerful tool for writing compositions. In fact, "many composition and language teachers believe that word processing encourages new pedagogical relationships in the class, by facilitating student revision and collaborative writing" [21].

Discussion boards at present are very similar to word-processing applications from the formatting of text such

as font faces, styles and sizes to the editing and deletion of words. Students can type their compositions directly into the discussion board or alternatively they can complete their composition in a word-processor and paste them into the board, making their composition readily available to be edited by them through author privileges and to be given feedback by students and teachers. Thus, the discussion board by virtue of design is a simplified word-processor, providing a platform on which students can discuss ideas and comment on each other's compositions.

Many composition teachers agree that composition writing takes a lot of preparation tasks from planning to drafting to editing to proofreading, and time invested in these activities onsite restricts opportunities for meaningful and comprehensible discussions [21]. This justifies the reason as to why English as a first language (L1) composition teachers were the earliest proponents of CMC using computer conferencing among the students in a class to enhance collaborative writing and the social production of knowledge [21].

Nonetheless, the potential of collaborative CMC is only as good as the benefits it brings compared to that of face-to-face communication (f+f). Prior to the Internet, traditional f+f itself has benefits that far outweigh group lectures, yet CMC is capable of replicating f+f in addition to new affordances. One study found that academic performance improved when f+f processes are complemented with CMC, establishing that, "a combination of face-to-face and computer-mediated discussion provides a superior learning environment compared to the traditional classroom alone" [19].

Bearing in mind that Computer Mediated Collaborative Learning is the main supplement to the f+f communication already present in the class, the benefits of implementing this change can be categorised into several aspects, notably (1) time, (2) quantity and quality of collaboration, (3) learning motivation, (4) the role of the teacher and (5) the facilities provided by the discussion board.

As mentioned earlier, 'time' is a fleeting component of classroom lessons particularly when the year's syllabus is a chock-a-block schedule of learning activities. Segregating the tasks to become independent of onsite presence allows students to proceed at their own time and pace [9], [20] and [22], and free up class time for other activities [20].

When students discuss in the classroom, not many can be presented on classroom tabletops within the expanse of a few hours prior to writing. With discussion boards, students are able to initiate discussions within the expanse of weeks and the discussions are more enriched because students are given opportunities to reflect carefully what they are about to contribute and what have been contributed, contributions can be edited and re-edited and there is equality in contributing. All these factors improve the quality of collaboration and consequently the resulting compositions [4], [22]-[24].

Equality in participation is a distinct benefit that CMC has over f+f. Equality is seen as "one of the most pervasive and beneficial effects of using electronic synchronous discussion in L1 writing instruction" [3]. One study found that "silent students increase(d) their participations online" and "those who are traditionally shut out of discussions (are) benefitting most from the increased participation," [9].

Learning motivation increases when students participate in online classroom discussions. This notion is validated by another study on students' motivation in using computers for composition writing [21]. Students' motivation increase because via CMC they become part of the community, develop thoughts and ideas and learning from others, they overcome isolation and feel less threatened when contacting others and also they believe computers help them learn English and write essays better [21]. The role of discussion forums in overcoming language learning anxiety is however not as defined as motivation and further research in this aspect is warranted [25].

There are instances where a teacher explains the writing task and moves around the class to provide quality individual attention to students, but oftentimes fail to attend to every single student due to time constraints. The online discussion board helps the teacher to access each student's work and provide valuable feedback outside onsite contact time. The teacher becomes the online moderator who organises the content, moderates and facilitates the social dynamics as well as commenting on the intellectual input submitted by students [26] and delegating roles to students [15] including providing peer feedback. Furthermore, students' compositions are accessible by peers, whereby peer proof-reading both lightens the teaching burden and encourages student reflexivity beyond their own schema of the writing task.

The discussion board itself brings several aesthetical benefits. It has similar functions to word-processors. It is capable of organising content and discussion thus preventing clutter. It is usually protected by a password entry thus allowing a class to maintain exclusivity of their discussion space. It doubles as a data archive where students can store and retrieve their compositions. It can be personalised based on design and functionality to suit the learning preferences of the students.

III. Discussion And Conclusion

The effective use of CMC to encourage online collaboration in composition writing is seemingly dependent on the strategies mentioned in the previous section, including but not limited to collaborative knowledge construction, synchronous and asynchronous communication, peer feedback, leveraging on its technical features of file sharing, Word-processor interface, collaborative writing, hypermedia links, and its capacity to promote motivation and equality of participation. This technology is however not without its challenges. Furthermore, there are conflicting opinions in literature on the shortcomings of CMC. One study believes that CMC motivates introverted students to participate [21], but another argues that, "lurking can occur... group members read the electronic discussions, but do not contribute" [16]. Moreover, "lack of non-verbal cues may diminish "social presence" [27] and "some students dislike the text-based nature of conferencing because of the increased time it takes to type messages and read other people's messages' [28]. The worst problem that may arise is 'information overload' whereby students may be overwhelmed by 'posts' thus ignoring them resulting in conversations becoming

monologues [9]. Extending from these issues of peer collaboration, web-based peer feedback do not benefit every student as success of the collaborative environment depends on how the feedback system is run and the quality of its collaborative exercises [13].

From a technical standpoint, technology always has the tendency to malfunction. Even when the provision of technology is adequate, other variables such as power supply or faulty hardware may come into play. One caveat is that anything that can go wrong will go wrong so it is advisable to have technical support to maintain the running of the online discussion board [4]. Fortunately, the challenges of implementing CMC in the classroom are far outweighed by the benefits gained from implementing it. Furthermore, the negative connotations originated from old studies when computers were not as reliable as today and students were not as computer literate as they are now.

This review has attempted to create a discourse pertaining to the benefits of implementing discussion boards in preparation for writing tasks. It has elaborated on the issues that need to be considered in relation to CMC and f+f. It is best to acknowledge that this medium acts as a supplement to prepare students wherein students' compositions can be improved through collaborative interactions. One theory attained from this review is the possible correlation between the quality and quantity of discussions and the quality of compositions. Ultimately, the theoretical underpinning discussed by this article provides a platform for future research into the advantages of online discussion boards and practical investigations on its effectiveness.

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Using Formative Conversation-based Assessments to Support Students' English Language Development

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Abstract—**In this article, we discuss the use of prototype formative conversation-based assessments designed to measure English learners' language skills. Conversation-based assessments are technology enhanced assessment systems that simulate interactions between a test taker and one or more virtual agents. We discuss preliminary findings from two studies exploring the use of conversation-based assessments to gather evidence of students' English language skills. The findings suggest that conversation-based assessments have the potential to provide useful information to teachers and students about the students' language skills and can be used to enhance and support English language development.**

***Index Terms*—Conversation-based assessments, English language assessments, English learners, English language development**

I. Introduction

Recently, there has been an increased interest in using a variety of innovative assessment approaches to support and enhance language development. Assessments are an integral part of learning as they help teachers obtain information about where the language learners are along their personal learning trajectory [1]. Assessments that have the potential to enhance learning involve the collection and interpretation of evidence about performance so that judgments can be made about further language development [2]. Thus, it is critical to develop language assessments that provide teachers and students with valuable information about the learners' language learning process.

We have leveraged advances in natural language processing in the field of intelligent tutoring systems [3] and applied Evidence-Centered Design principles [4] in the creation of innovative Conversation-Based Assessment (CBA) prototypes to gather evidence of English language proficiency through carefully planned conversations [5], [6], [7]. Conversations with computer agents can be used to gather evidence of student's English language proficiency that may be difficult to obtain using traditional assessment approaches.

The rest of the paper is organized as follows. First, Section II presents background of conversation-based systems, CBAs, and the structure of CBAs. Next, Section III describes the design of two formative CBA prototypes that were developed to assess young English learners. Then, Section IV describes two studies that were carried out to investigate and evaluate the two prototypes and Section V summarizes preliminary findings. Finally, Section VI presents conclusions and future research directions.

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II. Framework

A. Conversation-based Systems

Conversation-based systems can simulate conversations between a student and one or more virtual agents [8]. Conversation-based tasks are structured to provide opportunities for individuals to demonstrate their knowledge, skills, and abilities (KSAs), as well as to scaffold learning and provide useful feedback to students. Through the natural flow of the conversation, the virtual agents can repeat or rephrase their questions, ask follow-up questions, provide feedback on the quality of the responses, and provide scaffolds to elicit additional or missing information [5, 9]. Technology-enhanced conversation systems with virtual agents have been successfully used in the past as part of tutoring systems to facilitate learning for instructional purposes [3], [10], [11], [12], [13].

B. Conversation-based Assessments

Technology-enhanced conversation systems have also been used for assessment purposes. Specifically, conversation-based systems have been used to measure argumentation skills [14], science inquiry [15], and English language proficiency skills [5], [6]. These automated conversations involve dialogues between the test-taker and one or more virtual agents [7]. The main features of CBAs are the following:

- Students interact with virtual agents to create engaging and interactive environments. The interaction with the virtual agents allows for elicitation of more detailed information about the students' KSAs.
- Additional prompting is provided to redirect students to provide a different response or to elicit more information.
- Task-level feedback is provided in real-time immediately after the student answers a question.
- Scaffolds are provided when students are unable to answer a question; the type of support depends on how the student responds.

C. CBA Structure

In a CBA, each conversation starts with a main question and attempts to understand the students' responses during the

interaction with the virtual agents using computer natural language processing and automated speech recognition. The students' responses for each question are compared against a pre-defined expected answer with two natural language processing algorithms that have proven to be successful in the past, regular expressions and latent semantic algorithm [16]. Regular expressions are a way of capturing a key word or expression [17] and latent semantic analysis is a geometric matching algorithm that is designed to capture the contextual meaning of the phrase [18]. The conversations adapt to what students say/type in order to measure what students know about a particular construct. Once the system interprets the student's response, it will send the student through a particular conversational path (see Figure 1).

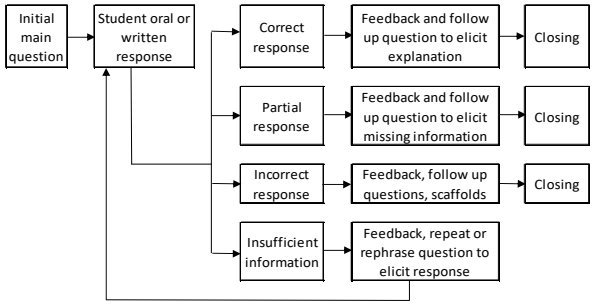

Figure 1. Conversation Paths in Formative CBAs.

If the student's response matches the predetermined correct response, it is interpreted as correct and it is sent through the correct conversation path. The virtual agents provide feedback on the quality of the response and ask follow-up questions in order to allow the student to explain his/her responses. If the student's response partially matches the predetermined correct response, it is sent through the partial conversation path and the virtual agents provide feedback and ask follow-up questions to elicit more information. If the student's response matches the predetermined incorrect response, it is sent through the incorrect conversation path and the virtual agents provide feedback, provide scaffolds, and ask follow-up questions to elicit a different response. Sometimes the system is unable to make a decision because it cannot interpret what the student says/types. This happens when the student says/types something off topic (not relevant to the topic of the question), requests clarification (e.g., I don't know, what did you say?), or does not provide a response. In this case, the response is sent through the insufficient conversation path and the system will prompt the student and give them additional opportunities to respond (e.g., by rephrasing the question or asking the student to elaborate).

III. THE ASSESSMENTS

We developed two formative CBA tasks to evaluate how they can be used to support young English learners in developing their English language skills. Prototype 1 is intended to measure both the English language proficiency skills and math content knowledge of middle school English learners and identify their language and mathematics difficulties for instruction and intervention. Some students might have low English proficiency but have high math skills and vice versa. Prototype 2 is intended to provide information about how to support the student's language development so they can learn mathematics. The prototype simulates a small group activity in which the student interacts with three virtual agents, a teacher and two peers. Figure 2 shows the interface for Prototype 1. This prototype includes seven conversations, each assessing a different facet (or aspect) of a broader construct of language (e.g., following oral directions, understanding information in texts and tables, and getting information from math problems and tables) and mathematics (e.g., ratios and unit rate). Students participate in the conversations by typing their responses in the computer interface.

Figure 2. Prototype 1 Interface.

Prototype 2 was designed to measure the English proficiency of students approximately 8-11 years old learning English in countries where English is not used as a first language. This CBA targets different listening, speaking and reading constructs: understanding oral and written directions, answering simple questions, and identifying and summarizing key ideas. Prototype 2 is divided into seven conversations which simulate interactions between the student and four virtual agents to learn about the weather in the United States. In this CBA, the student interacts with a teacher, a school librarian and two peers in three different settings: a classroom, a school library and a science museum. Students participate in the conversations by recording their spoken response using the computer interface. Figure 3 shows the interface for this prototype.

Figure 3. Prototype 2 Interface.

IV. THE STUDIES

We conducted two studies to evaluate whether the intended KSAs were elicited by these CBAs. In the first study, we

administered Prototype 1 to 82 middle school English learners from two schools in the United States. The main goals of this study were to examine how middle school English learners interacted with the CBA and to compare the students' performance on the CBA to their performance on more traditional measures. In particular, we addressed these research questions: 1) How reliable was the CBA system in interpreting student responses? 2) How do students perform on traditional measures compared to their performance on Prototype 1? 3) Can Prototype 1 be used to evaluate students' strengths and weaknesses in both language and mathematics? And 4) What perceptions do students have of Prototype 1? The CBA and the more traditional measures for the study were administered on a desktop computer using Internet Explorer. Students began the study by completing the CBA. Then, they completed a survey related to user perceptions. Following the survey were three abbreviated independent measures to collect data on students' skills related to mathematics (proportional reasoning), listening comprehension, and reading comprehension. The data collected for this study included the students' responses and scores for each of the questions in the CBA, scores on the math measure, scores on the listening comprehension measure, scores on the reading comprehension measure, and responses on the survey.

We conducted another study using Prototype 2 to examine the students' perceptions in regard to their experience completing this prototype and to explore the use of different feedback types to elicit missing or additional information. The main research questions were: 1) What perceptions do students have of Prototype 2? And 2) Do students respond differently to different feedback types? We included three types of feedback in the conversations to create three different versions of the same task. The corrective feedback was provided only when the response was partial or incorrect. In the first version, the virtual agents provided feedback by asking a specific question to elicit more information (focused/cued feedback). The feedback in the second version consisted of the virtual agents indirectly rephrasing the students incorrect or incomplete responses to provide the correct response (recast feedback). In the third version, the virtual agents provided feedback by telling the students their response was incorrect and prompting them to change it (try again feedback). Table 1 illustrates the three feedback types. In this example, students are expected to say that they are going to learn about the weather in the United States.

Table I
FEEDBACK TYPES IN PROTOTYPE 2

Type	Sample feedback
Focused	Lisa: Yes, we are learning about the weather. Ron: In what country are we learning about the weather?
Recast	Lisa: Yeah, we are learning about the weather in the United States. Ron: Wait, Lisa. Let the new student tell me. What did the teacher say we are going to learn today?
Try again	Lisa: Yes, but it's not about any weather. You need to tell Ron more. Ron: What did the teacher say we are going to learn today?

The virtual agents are trying to help the student provide the missing information (i.e., the United States). The main questions and the expected responses were the same for all versions. Eighty English learners from an elementary school in South Korea participated in this study. Students were randomly assigned to one of the three feedback versions. The data collected for this study included student responses to Prototype 2, background information questionnaire, and post-study survey.

V. PRELIMINARY FINDINGS

The results from Study 1 showed that the CBA system was able to score responses in Prototype 1 reliably. The agreement between the scores assigned by the CBA system in Prototype 1 and the consensus scores assigned by two human raters was high (94% agreement). We also found that the language and math scores on Prototype 1 had a significant positive correlation with the external measures (r=.52 language, r=.56 math). An ANOVA revealed the Prototype 1 language score accounted for a significant portion of variance on the external language measures (21.6% of the variance in listening and 28.8% in reading) and the Prototype 1 math score accounted for a significant portion of variance on the external math measure (33.3% of the variance). Prototype 1 also provided evidence of the students' strengths and weaknesses, both in language and mathematics. The student responses provided information about the students' ability to understand a word problem, to find information in a table, to understand the meaning of ratio, and to understand how to write a ratio. The majority of the students were able to answer the virtual agents' questions (87%), and used the feedback and support provided by the virtual agents to engage in the task and to correct their responses or to articulate missing information. We also found that students had positive perceptions about Prototype 1 and about interacting with the virtual agents (82.1%).

Similarly to what we found in the first study, the majority of the participants in the second study also had a positive perception of Prototype 2 (75%). Some students reported that it was interesting to interact with the virtual agents because they could practice speaking in English and they could learn new words (37.5%). We also found that some students were able to provide more information or change their responses based on the feedback they got from the virtual agents (51.3%). Although more students were able to change their responses with the *try again* feedback (18 students) than with the other two types of feedback (14 students with the *recast* feedback and nine students with the *focused/cued* feedback), only four of them were able to correct their responses or provide the missing information. Six of the nine students who received the *focused/cued* feedback and eight of the 14 students who received the *recast* feedback were able to either correct their responses or provide the missing information.

VI. DISCUSSION

The main contribution of our studies is that we provide empirical evidence that formative CBAs have the potential to create engaging and interactive environments to measure the language skills of young English learners [5]. Engagement is especially useful for promoting language learning [19]. In both studies, we found that the majority of the students enjoyed interacting with the virtual agents and liked that the agents supported them in completing the activities. Students in the second study reported that the CBA gave them an opportunity to practice their English skills by interacting with the virtual agents. The students' level of engagement while completing the CBAs was reflected by their willingness to spend time and effort to complete all the tasks.

The use of additional prompting and scaffolds allow formative CBAs to collect rich evidence of the students' progress and achievement. In our two studies, we found that the responses to both the initial and follow-up questions contributed to assessing the students' language skills. The interactions with the virtual agents allowed for elicitation of more detailed evidence of students' English language skills [5]. Likewise, the additional prompting helped not only to progress the conversations but also provided useful information about the students' strengths and weaknesses in their language development. Although additional research should be conducted to substantiate the CBA system-derived diagnostic information, it could potentially inform teachers and learners about areas in need of improvement.

In formative CBAs, students are able to interact with the virtual agents to complete a specific goal. In this interaction, students receive timely and frequent feedback that varies according to how they respond to each question. Students could use this feedback to monitor their progress toward achieving their goal [20]. The effectiveness of the feedback is essential to successful language development [21]. Thus, it is important to examine different ways to provide effective feedback to English learners.

Planned future work includes more empirical evidence to validate the use of CBAs to measure the language skills of young learners, including using CBAs for diagnostic purposes. Other work includes exploring the use of formative CBAs to assess different language skills. Equally important is examining and improving the accuracy of CBAs to interpret English learners' spoken and written responses.

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Measuring English Pragmatics Skills through Game-Based Performance

G. Tanner Jackson, Patricia Inglese, Jennifer Wain, Veronika Timpe-Laughlin, Lindsay Grace

***Abstract*—The current work describes efforts related to the evaluation of a game-based assessment called "Awkward Annie" which targets English language pragmatics by having players intentionally select the most awkward responses. Results are explored from 328 native English speaking adults collected through Amazon Mechanical Turk. This article explores a conceptual model of potential relations between individual differences, user experience, game performance, and English pragmatic skills. Specifically, results suggest that a foundational understanding of how to be inappropriate has significant implications for user experience and game performance, both of which are related to overall English pragmatics skills.**

***Index Terms*— Educational Games, English Pragmatics, User Experience**

I. Introduction

Successful communication requires more than the ability to form grammatically accurate sentences; it involves an awareness of the socio-cultural environment, the interlocuters, and the local context in any given communicative interaction. While traditional language learning instruction provides a foundation of what to say, pragmatics focuses on the more nuanced understanding required to know how to say what to whom and when [1]. Sociocultural linguistic skills can be learned through direct instruction and/or conversational (immersed) experience. However, these face-to-face educational approaches can be costly and/or impractical to implement (e.g., traveling to another country) and are frequently absent from traditional classroom environments [2]. The growing feasibility and popularity of educational games, provides a technological platform for pragmatics instruction and provides the advantages of being experiential, engaging, and fun [3]. Additionally, an educational game offers a cost effective platform for distribution, in a low stakes environment affording many opportunities to engage, experiment, learn, and fail. Thus, Game-Based Assessment (GBA) for measuring English language pragmatics is a promising area of research due to its critical role in communicative language use.

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II. English Language Pragmatics

Pragmatic ability refers to the appropriate use of language in a particular socio-cultural context. Pragmatic ability helps people deliver and interpret a communicative message as intended and is therefore considered to have a major role in successful communication [4], while a lack thereof has been known to cause severe communication breakdown in the workplace [5] and create a negative impression of the speaker [6]. Despite its recognized importance, materials specifically targeting pragmatic instruction and assessment are limited.

Because pragmatic ability relies on an understanding of social and cultural norms, an assessment of the construct requires the presentation of rich contextual and sociocultural input, making an adaptive online virtual environment more feasible and appropriate than traditional text-based instructional materials [7]. The field of pragmatics currently lags behind other fields in terms of educational games for learning [8], and most pragmatics game research has been conducted by only one researcher, Julie Sykes, and her colleagues who focus exclusively on the acquisition of Spanish pragmatics [9]. To advance the field into the learning and assessment of English pragmatics, the GBA being developed for this project aims to represent some of the complexity of sociocultural interactions by providing the necessary contextual information (e.g., character backgrounds, power relationships, sociocultural environment) to assess English pragmatic awareness within an engaging and interactive game design. Next, we will discuss the specific designs of that GBA followed by details of an empirical evaluation.

III. Game-Based Assessment Design

Interactive GBAs have the distinct advantage of providing a more engaging instructional format than traditional methods, showing consistently higher associations with motivation and persistence, which are two critical components of learning [8]. GBAs are well-suited platforms for pragmatics learning and assessment given that contextual information and feedback, critical pragmatics components, can be saliently presented. Additionally, the interactive nature of simulation games mimic the real world, activating processes from social constructionist and experiential learning theories [11], [12].

The design goal for the current GBA was to engage adults and measure aspects of English language pragmatic dependencies across three social dimensions (social familiarity, power differences, and imposition size). These social dimensions, identified in prior work [13], are considered a foundational means to elicit and identify pragmatic ability.

In addition to assessing pragmatic ability, the current work also aimed to investigate the impact of game design choices on

user experience. An Evidence Centered game Design approach (ECgD)[14] was used to iterate over game concepts which attempted to balance game and assessment design constraints. Ultimately this process resulted in a decision to use a series of selected-response conversations which evolved into a game called Awkward Annie (see Figure 1). Annie is an employee starting a new job set within an experientially rich environment including conversations between people with varying degrees of familiarity and a diverse hierarchical environment (i.e., strangers and friends as colleagues and bosses). Sampling these features across the social dimensions facilitates the assessment (and learning) of pragmatic abilities [15].

Awkward Annie's design takes an unorthodox approach to conversation selection by having the players intentionally select the most inappropriate and awkward response. It was hypothesized that reversing the goal (being inappropriate rather than appropriate), would improve the design from a game perspective by allowing users to play with social norms and potentially escape from reality by interacting in ways not feasible or socially acceptable during day-to-day interactions. This approach also allows for the inclusion of more playful and amusing conversations with exaggerated Non-Player Character (NPC) reactions [3], [16]. A potential limitation from the perspective of pragmatic literacy assessment, this strategy depends on the assumption that identifying the least appropriate response indicates knowledge of the appropriate response (by the absence of its selection).

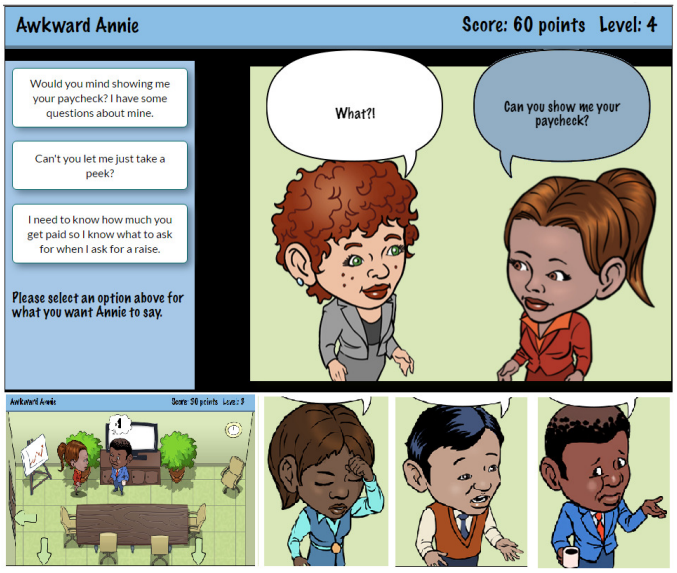

Figure 1. Awkward Annie conversation selection (top panel), environment (bottom-left), and characters (bottom-right).

Thus, Awkward Annie is a GBA where users play the role of "Awkward Annie" who is an odd, but endearing character who humorously fails at social interactions (top-right character in Figure 1). Players navigate through an office environment to engage in the conversations with NPCs (bottom-left of Figure1). In each conversation the player is presented with three dialogue options (appropriate, mildly inappropriate, and most inappropriate) and asked to select the most inappropriate statement, which is then displayed as Annie's conversational turn. Scores were awarded based on the correctness of the selection and a minimum score was required to complete a given conversation (see procedure below for specific values). A conversation can be replayed until the minimum score is reached for players to progress to subsequent conversations with a particular character; however, players may interact with any of the currently available characters in the order of their choosing. When players select awkward statements they can watch as the NPCs find this behavior strange and rightly react to her ostentatious shenanigans (bottom-right images of Figure 1), but (amazingly) continue to tolerate her.

IV. Study Design

The current study aims to explore several factors related to GBA design of English language pragmatics. Specific research questions include: RQ1) how does the evidence from Awkward Annie relate to a conventional measure of pragmatics, RQ2) how do users perceive their interactions with Awkward Annie, and RQ3) how do aspects of user experience relate to various measures of performance (game and external survey)? Specifically, this work explores relations among pragmatic performance, game performance, user experience, and individual differences. A previous study with predominantly non-native English speaking adults revealed significant trends among these critical variables [17]. The current work expands on that initial study and aims to establish a baseline of relations through a sample of 328 native English speakers. Participants were recruited through Amazon Mechanical Turk (MTurk), received $10 for participating, and the sample self-reported as 43% female, 79% as Caucasian (8% African American, 7% Asian American, 8% Hispanic or Puerto Rican, and 2% Native American/Alaskan), and 84% as being between 21 to 45 years old.

A. *Procedure*

Participating adults worked for one hour and completed three self-paced phases: presurvey, gameplay, and postsurvey.

Presurvey. Participants used their MTurk ID to log in and begin the presurvey, which took approximately 15 minutes. The presurvey was used to collect demographic information as well as participants' education, languages spoken, self-reported use and application of the English language, and use of and comfort with technology. The end of the presurvey presented introductory information for Awkward Annie.

Awkward Annie. After completing the presurvey, participants played Awkward Annie (v1.39) for approximately 15-20 minutes. As previously described, Awkward Annie focused on the adult workplace and included 18 total conversations with the NPCs, with each conversation consisting of three user turns. In v1.39 individual response scores for appropriate, inappropriate, and very inappropriate corresponded to 0, 3, and 5 points respectively, with a minimum of 10 points needed to complete a conversation.

Game performance was represented by two variables: game success efficiency and average conversation score. Game success efficiency (% Success) is the number of successful

conversations divided by the total number of conversation attempts, then multiplied by 100 to produce a percent. This variable represents players' effectiveness at navigating the conversations with a higher value indicating more successful game play. Each player's average conversation score (Avg Score) serves as an indicator of how well they discriminated between the three conversational options (appropriate, mildly inappropriate, and most inappropriate). A higher average score per conversation indicates more successful discrimination.

Postsurvey. After playing the game, participants completed the postsurvey including items related to their user experience (UX) and English language pragmatic ability. The UX questions consisted of 26 likert scale items (1-strongly disagree, 6-strongly agree) focusing on positive aspects (e.g., "I had fun while working on the game"), negative emotions (e.g., "I was frustrated while playing the game"), basic gameplay (e.g., "I understood how to play the game"), and general perceptions (e.g., "I felt that the characters responded appropriately to my choices", "I selected statements to the best of my ability"). Pragmatic skills were assessed through 27 conventional selected-response items requiring identification of appropriate language use within particular contexts.

V. Results

Analyses focused on identifying basic relations between English language pragmatics skills, game performance, and user experience. Initial analyses on the proportion of correct responses on the postsurvey revealed a range of pragmatic ability for these native English speakers (M=.77, SD=.08, range=.57). Subsequent correlations yielded a significant positive relation between the postsurvey pragmatics performance and both game performance variables (% Success: r=.132, p=.017; Avg Score: r=.158, p=.004). These initial results provide evidence that Awkward Annie gameplay captures aspects related to players' pragmatic ability (RQ1).

An interesting caveat is that players' performance within the game is significantly correlated with how well a player "understood how to play the game" through the underlying mechanic of selecting the most inappropriate conversation option (% Success: r=.183, p=.001; Avg Score: r=.164, p=.003). However, understanding how to play the game was not significantly related to pragmatic skills (r=.056, p=.304). Thus, pragmatic ability did not appear to impact players' ability to understand that the intent was to be awkward.

After examining the initial performance relations, subsequent analyses focused on how the unique mechanic of being awkward impacted players experience and perceptions (RQ2). Specifically, Table 1 displays a representative subset of correlations exploring the relations between individual items that represent the aforementioned categories of user experience variables (positive, negative, gameplay, and perceptions). For example, players who had fun while playing Awkward Annie (#1 in Table 1) were also less frustrated (#2), had a better understanding of how to play (#3), liked selecting awkward statements (#4), felt like the characters reacted appropriately to the selections they made (#5), felt that they performed to the best of their ability (#6), and (#7) felt that the interaction was more playful (i.e., less like homework).

Table 1. User Experience Correlations (n=328, all p<.001).

	(2)	(3)	(4)	(5)	(6)	(7)
(1) Had fun while playing	-.552	.336	.636	.369	.222	-.659
(2) Was frustrated	1	-.281	-.468	-.309	-.188	.451
(3) Understood how to play		1	.292	.350	.548	-.352
(4) Liked being awkward			1	.321	.258	-.608
(5) Appropriate reactions				1	.248	-.442
(6) Performed at my best					1	-.332
(7) Felt like homework						1

Interestingly, there were no significant relations among technology usage (frequency of using computers, comfort level with technology, frequency of playing video games) and players' understanding of how to play the game, game performance, or even pragmatic skills (all p>.05). Although the game mechanic itself (being inappropriate) may be somewhat out of the ordinary, the game design did not require significant technical expertise to engage.

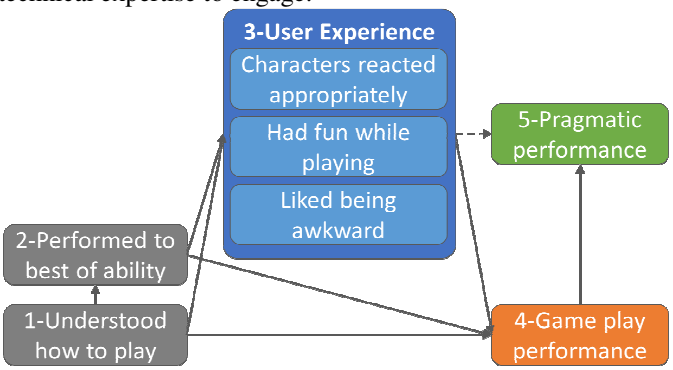

Figure 2. Proposed conceptual model of study relations.

Synthesizing these and additional correlations, a tentative conceptual model is proposed in Figure 2. The findings suggest that a player's reported level of understanding how to play the game (#1 in Figure 2) relates to their overall user experience (#3) as well as both their perceived (#2) and actual (#4) performance levels in the game. Thus, people who understood the intent to be awkward found the experience to be fun, playful (less like homework), and knew how to succeed in the game (RQ3). Conversely, understanding the need to be inappropriate may pose a difficulty for certain users, and those users seem to have difficulty playing and enjoying the game. Additionally, a player's perception of performing to the best of their ability (#2) has a significant impact on their experience (#3) and game performance (#4), with the latter variables (#3, #4) being positively related to pragmatic ability (#5)(RQ3).

VI. Conclusions and Discussion

Overall, the Awkward Annie efforts provided an operational conceptualization of (a portion of) English pragmatic ability aligned with existing literature [15], developed a GBA which addresses these skills, and conducted an investigation of relevant factors for game and pragmatics performance.

Although the results from the set of performance relations may draw a subtle distinction, it is an important one for the design of the GBA. Namely, for people who understood that the goal of the game was to play as an awkward character (i.e., not how they likely behave in everyday life), their game performance was significantly related to their pragmatic performance (RQ1). Additionally, understanding this novel intent of the game was not reliant on already having a specific level of pragmatic ability. This suggests that the Awkward Annie environment is successfully measuring aspects of English pragmatic ability, and that particular pragmatic skill levels may not be a prerequisite to understand the game. These results are also consistent with an initial study using predominantly non-native English speakers [17]. These results are informative for assessment purposes as the unique approach to confirming the negative response (being inappropriate) does appear to be providing evidence of the overall competency (RQ1). The findings are also relevant for education and game-based research communities due to the novel game design, associated successes, and shortcomings.

In addition to the performance variables, the current work investigated a variety of factors that contribute to the resulting experience with the environment and impact perceptions of performance (RQ2). Specifically, people who enjoyed the experience really enjoyed the playful nature of being awkward (as hypothesized during design). Additionally, those people who understood how to play (i.e., intent was to be awkward), also reported that they played the game to the best of their ability (and, in fact, they did have higher game performance scores). It appears that once people understood the game was designed as an escape from reality where they should drop social norms to explore inappropriate interactions, it afforded much more positive and productive experiences (RQ3).

In terms of the Awkward Annie GBA, these results suggest revisions to certain key areas targeting the clarity of game navigation and pragmatically appropriate content will need to be addressed. Based on the findings above (understanding gameplay and user experience), future efforts will empirically address how choosing the inappropriate (vs. appropriate) response impacts aspects of engagement and the measurement of pragmatic ability. Additionally, the novelty, enjoyment, and impact of selecting (in)appropriate options may be dependent upon the timescale of interaction (short or long) [18].

Another aspect of the game that will merit further refinement is the conversation options. Although the Awkward Annie pragmatics content was developed based on prior research [19], qualitative, offline feedback suggested that some users found it difficult to choose between the mildly and most inappropriate responses. These users noted that both options were often awkward enough to be considered the "correct" choice. While this difficulty may have affected the average score per conversation, it should not have significantly impacted overall conversation success rates. Additional efforts are now underway to refine and norm the game content.

Despite these potential limitations, and the tentative nature of the conceptual model, the current work with Awkward Annie has illustrated some of the potential for the environment and provided initial support for this unique approach. This work has identified several key factors and constructs that may have significant impact on game design, game-based assessment practices, and measures of pragmatic ability.

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Why Will Technology Enhanced Language Learning be Essential for Pupils?

Markus Ebner, Martin Ebner and Konstanze Edtstadler

***Abstract*—The availability of personal digital devices in schools and at home are offering new ways of engaging students in the area of language learning. In this publication, we present a new approach on writing and blogging for children aged 8 to 12 years, which is especially helpful for those who struggle with the acquisition of German orthography. On a web-based platform the pupils can write essays and blog them later on. Combined with learning analytics methods we offer individualized feedback during the process of writing and a training database with appropriate exercises to support the students' autonomous learning.**

***Index Terms*—educational media, German spelling acquisition, learning analytics, technology enhanced language learning**

I. Introduction

Learning Analytics (LA) has gained more and more recognition and importance since it was first mentioned in the Horizon Report 2012 as a forthcoming trend [1]. Long and Siemens also referred to Big Data and Analytics as the most important influencing factors for the future of (high) school education [2]. LA itself benefits from the ability to collect a variety of different data from each user [3] in order to examine the learning activity and the learning behavior more closely. The combination of Technology Enhanced Language Learning (TELL) with LA makes it possible to better understand the language learning itself [4] and to automatically identify and classify learners according to their skills and competences in order to better support them [5] in language learning. In our approach we strongly focus on TELL and LA in the field of German orthography to provide students and teachers with relevant data, which reflect the learning behavior of each individual learner, thus enabling individualized and personalized support [6] with appropriate exercises [7].

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II. Language Learning in Elementary Schools

A. Overview

In this publication we want to present an ongoing research work in the area of TELL and LA. Nowadays, the availability of personal digital devices in the schools and classrooms offers new ways of engaging students, also supported by the broad availability of smartphones and tablets to use internet based applications [8], [9]. This allows us to discover new ways of learning for children in the research fields of mobile learning (ML), LA and TELL. With the IDeRBlog project we try to combine the acquisition of German orthography with text writing, especially blogging, by the use of modern digital instruments [10]. The current development is unique in the field of literacy acquisition. Until now, fundamental requirements for acquiring German orthography (cf. [10]) could only be fulfilled by a highly professional face-to-face training. Especially giving more specific feedback than to look up a word in a dictionary for correcting misspelled words was only possible in an individual setting. The current development facilitates the implementation of an individual approach. So the main research question addresses the idea, how to design an information system for pupils, in order to assist them to improve their spelling ability combined with writing (publishable) texts.

B. Background

Writing, besides reading and calculating, is one of the basic skills pupils have to acquire in (elementary) school. It is indispensable for the future participation in social life and society. Especially, in the German speaking areas of Europe, correct spelling is considered prestigious [11]. Therefore, it is of great interest for teachers to identify shortcomings in the area of orthography at an early stage in order to take appropriate measures to eliminate them [12].

Our approach offers the pupils a web-based platform where they can write short texts in form of blog entries. In contrast to hand-written essays, these texts can be analyzed semi-automatically. In the first step, feedback is provided for correcting spelling mistakes. In contrast to an usual auto-correction system these feedbacks do not simply offer the correctly spelled words but strategy based hints for correcting them in order to improve the child's self-correction and orthographic competence [10]. This is the unique feature of the system as it takes in account several aspects of research in the field of German orthography and its acquisition. The teachers

benefit from the initial evaluation of the text as it provides a qualitative analysis of the spelling mistakes in order to gain insight into the problematic orthographic areas of each pupil. For this purpose, the misspelled words are categorized and assigned to specific phenomena by the intelligent dictionary [10], [13], [7].

This evaluation makes it possible for the teachers to take appropriate measures for supporting each single child, such as explanations and appropriate individual online exercises as well as worksheets, which are also offered on the platform [10]. Furthermore, the progress of the child can be monitored over a longer period of time and made available to the pupils, parents and teachers. This makes it possible to address the child in a more individual way. Subsequently, the analysis of the data allows a better understanding of the spelling acquisition process and allows new didactic approaches [14].

C. Approach

In order to set up the platform we had to fulfill different criteria for our stakeholders: students (age 8 to 12 years), teachers, parents and researchers.

First, we had to assure that the platform is easy and simple to use. The presented feedback and the platforms design have to be as simple as possible to avoid confusion and misinterpretation

Fig. 1. Figure creation: first scratches on the left and the final mascots from the website on the right. The different mascots are offering different function for the students (from left to right): writing, exercising, reading [14].

between the various stakeholders [15], [16]. Therefore, we included students from our partner schools as co-designers of the platform, as suggested in NMC Horizon Report [17]. By the aid of a graphic designer we drafted different color schemes and mascots. With this approach we could assure to create a graphically appealing and age appropriate website [18]. After evaluation and rating by the students we developed the favored design further and integrated it in our concept. Fig. 1 shows scratch and final mascots from our website [14].

Second, we didn't want to create a simple spell checker. Therefore, in case of a spelling mistake, we provide hints to the student for correcting the misspelled words (within the so-called "intelligent dictionary"). This aims to encourage the pupils to reflect about the language and become aware of the word structure, which is important for acquiring the orthography [24]. The provided feedback is based on the theory of German orthography and formulated in an understandable way for the target group. As the feedback is strongly connected with the qualitative analysis, its requirements were analyzed and considered [13]. For constructing the intelligent dictionary important words as well as frequently misspelled words and their word forms are collected [10]. In a next step, their corresponding misspelled word forms are "invented" depending on the - previously defined - fine grained phenomena which are subordinated to the coarse grained categories of the qualitative analysis [10]. This means, that each misspelled word form, that causes a specific feedback for correction, is connected with a

Fig. 2. Example of a text correction [19].

phenomenon - and subsequently with its category - that is representing this type of mistake. The hierarchy of phenomenon and category allows us to stay flexible and to add or delete phenomena evidence-based on the long run. This systematic approach will lead to a deeper and representative understanding of the most problematic areas of German orthography.

Fig. 2 points out an example with hints to correct the misspelled words. The text in English means: „Today we discovered many new things in the woods. The distance between our camp and the river was very far" [19]. The student made two spelling mistakes: *enddeckten* (translated: (we) discovered) with <*end> instead of <ent> and *Endfernung* (translated: (the) distance) with <*End> instead of <Ent>, which are shown to the student with the appropriate hints for correction: "Think about the spelling of the world building brick" [19].

Third, we wanted to provide a suitable training database with exercises for students, teachers, and parents. Therefore, a pool of around 260 online and offline exercises has been created for different error categories [14]. The teachers get a more detailed presentation of the challenging areas from the individual student or the class with more detailed recommendations in correspondence to the categories of the qualitative analysis of the spelling mistakes.

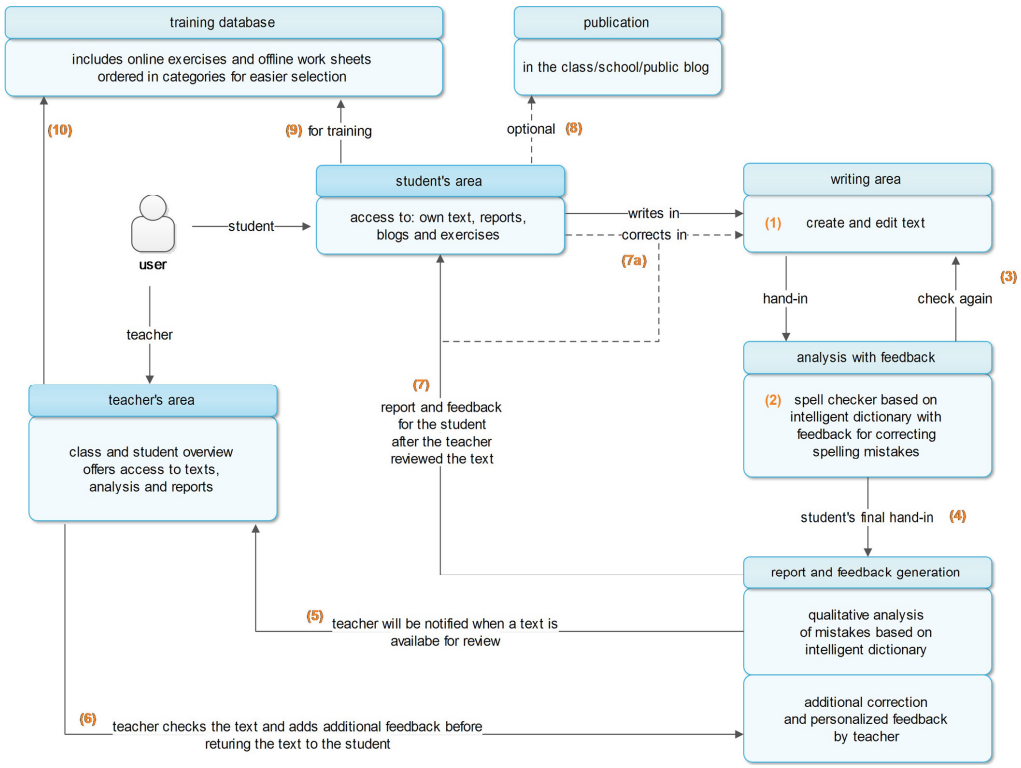

Fig. 4. General workflow for teachers and students [7].

Fig. 3 shows the feedback overview from the perspective of a student. The top 5 error categories are listed and recommendations for exercises (on- or offline) are offered. Additionally, the student should take the interactive spelling courses consistent with the spelling problems, which offer an explanation and are also offered for free on the platform.

Fourth, we had to assure that the students will use the platform frequently. Therefore, we decided to include a blog system in it to "provide relevant reasons and audiences for writing" [20]. Compared to a typical essay writing in a classroom, it can be expected that the motivation to formulate and revise a text many times is higher with the opportunity of publishing it in a blog [10].

III. Workflow

Fig. 4 shows the general workflow on the platform for teachers and students. A pupil writes the text in the provided writing area (1). After the orthographic analysis of the submitted text, conducted by the intelligent dictionary (2), proper feedback is provided to the student. Now the student can further correct the text as often as needed (3) or submit the text (4). This intermediate step ensures that the student can correct spelling mistakes independent and self-reflexive [21]. After submission the teacher gets a notification (5) for reviewing the text. The teacher now has the possibility to correct and/or add additional feedback (6) to the text. A report is generated and sent back to the pupil (7). The student's parents are also able to access the platform in order to supervise the progress and the suggested exercises. The teacher can instruct the student to redo the essay and send it back to her/him with additional hints and comments beyond orthography (7a). The student can choose to blog the essay in the provided blogs (8). Recommendations for training exercises are provided by the system to the student (9) and the teacher for the student and class (10). [7]

IV. Discussion

This paper presents a new approach on TELL assisted by LA techniques for identifying orthographic areas of interest to work on and the overall progress of the student. A unique feature of this platform is the automatic feedback for the students during text creation, provided by our intelligent dictionary [10], [7].

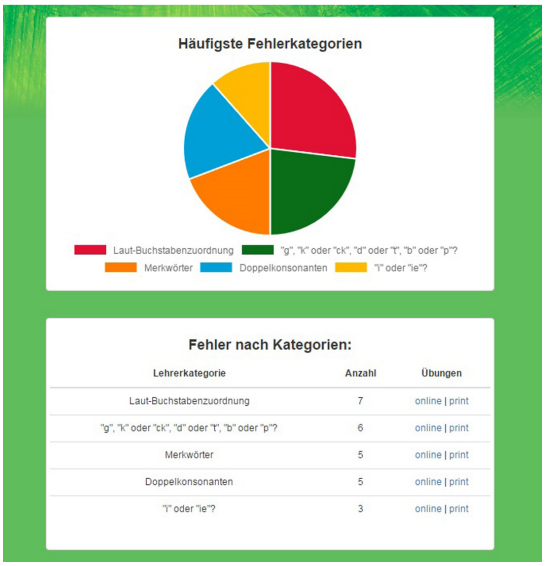

Fig. 3. Individual feedback view with recommendations for training database exercises for students and parents.

The qualitative analysis for teachers supports the selection for proper exercises for the class. Further, the training database provides recommended exercises for teacher-centered and learner-centered learning. In-depth analysis [22] will be conducted to understand the process of spelling acquisition in more detail. The analysis of systematically made mistakes for teachers allows the measurement of the student's individual or class performance, in the long run [23].

It can be summarized that our approach consists of the possibility for pupils to provide a web platform, where they can compose and publish short essays, which are checked against the intelligent dictionary to point out failures in real time. In the background misspellings are tracked and result in an overview diagram to display systematically wrong written words ordered by orthographic categories. This should help pupils to enhance their writing skills through technology in a meaningful manner. As this is the first development in the field of LA and German orthography the currently existing intelligent dictionary can be labeled as a prototype, which works well and has the power to be developed further, especially by integrating much more words and its corresponding mistakes. Feedback and experiences from schools gathered so far show reveal high acceptability. For example, 149 students of our partner schools (grade 3 to 6) submitted between October 2016 and January a total of 429 texts. [7].

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JSON Based Interactive Online Concept Mapping Tool: *CmapEditor*

R. Kumar

***Abstract*— Concept Map is popularly known as a knowledge representation tool or knowledge visualization tool. The existing tools support creation of maps with different features but are found to be lack of many basic features. To mention a few are interactivity, scalability, hiding/expanding the submissive concepts and availability. Most of the tools are not accessible online as they are standalone tools. Hence, simple yet interactive tools with improved features would be highly appreciable today. This paper explains the attempt made to develop an online software namely *CmapEditor* for interactive concept mapping and was developed using Java Servlet pages, Java Script and Java Script Object Notation. Further, the tool was evaluated in order to determine whether or not it is useful and creates a positive impact among the users.**

***Index Terms*— Concept Map, Software Design, CmapEditor, JavaScript Object Notation (JSON), Interactive Tool.**

I. Introduction

Concept map (CM) is a graphical tool that helps in organizing and representing our knowledge. CMs include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a labelled arc that links two concepts where the words on the arc specify the relationship between the two concepts. The founder of CM Novak [1] defines CM "*as a perceived regularity or pattern in events or objects, or records of events or objects, designated by a label*". CMs are also known as knowledge visualizers. According to the study [2], CMs have been widely used in many disciplines. To name a few; education, knowledge management, software engineering and many others. CMs have been used in school education for both teaching and learning processes. Recently, researchers started using the CMs for assessment [2 & 3] activities along with or replacing traditional assessment methods. Many researchers have reported the usage of CMs in knowledge management activities like knowledge representation, knowledge acquisition and training as a means of capturing and representing knowledge and applications of CM to different domains across various are reported by Kumar *et al.,* [3].

Today, technology supported learning is catching up everywhere and the rapid growth of Information and Communication Technologies enables software developers to introduce new tools that support more interactive features thus provide better user experience. Introduction of interactive concept maps is essentially viewed as an important progress in terms knowledge visualization that facilitates knowledge sharing in educational setups.

The focus of this work is on the development of a new concept mapping tool with simple interactive features which are mandatory as well. A novel concept map construction and manipulation tool namely *CmapEditor* is proposed, designed and developed. CmapEditor allows the users to create interactive maps for a topic of interest.

As mentioned above, this paper presents the author's experience in developing the *CmapEditor*. The rest of the paper is organized as follows; section II presents the overview of the existing CM tools in terms of their features, section III analyses the *CmapEditor* requirements, section IV discusses the designing of *CmapEditor*, section V explains the development of *CmapEditor*, section VI presents the evaluation of *CmapEditor* and section VII concludes the paper.

II. Overview of Existing Concept Map Tools

There are handful of software and tools available for creating and using concept map. The tools are available as either commercial tools or free and open source tools [6]. Most of the tools are stand alone i.e. desktop applications while the few others are online or web based applications. Presently, the concept mapping tools provide features like creating, viewing, storing, editing and sharing the maps and also allow users to collaborate in concept mapping. It is observed that they do not provide interactive features while viewing the maps. In the case of some tools, it observed that loading of the maps to the screen require considerable time.

Further, most of the tools follow own proprietary file formats and modes for storing the map while few others support the standard formats. For example IHMC's CmapTool uses its own format of storing the maps which forces the user to have Cmap Tool installed. Currently, majority of the softwares support both 2D while Microsoft's 3D Topicscape supports 3D concept mapping. Though there are custom developed CM tools and evaluators available, all of them found with lack of support to interactive maps. Interactive maps are kind of maps which allow the users to interact with the map elements. Another tool Prezi [7] provides zoom feature over the contents of the map but is used for presentation purposes. The Prezi uses an advanced user interface called Zooming User Interface (ZUI). ZUI allows users to zoom in and out of their presentation media, and allows users to display and navigate through information.

To summarise, eventhough the existing tools provide essential features to create and manipulate concept maps, majority of the tools do not support interactive features while handling concept mapping activities and portability is not supported as well. Hence, it would be appealing if the following features are included in the tools:

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- Navigation among nodes
- Expand /hide nodes
- Trace or track the navigation path

These are considered as the important features for the proposed prototype.

III. Software Requirement Analysis

Any software development process needs to undergo a rigorous requirements analysis process in order to confirm and finalize the functionalities and associated processes. The proposed tool development has also passed through a complete requirement analysis process. As concept mapping was practiced in the classrooms, the authour considered suggestions recieved from the studetns along with identified functional requirements from the analysis of existing tools. The functionalities like creating a concept map in an online environment, high degree of interaction features, easily editable, scalable etc., were identified. The functional requirements are then categorized based on the core software components like user interface, interactivity, storage mechanism and work environment. Table 1 presents the important functionalities considered .

TABLE 1. FUNCTIONAL REQUIREMENTS IDENTIFIED

Module	Requirements	Description
User Interface	Simple GUI	Simplified graphical canvas that enables the user to create maps by clicking (to create /edit map : add node, add relation, change node / relation. Store / retrive etc.,)
	Menuless / Buttonless interface	The actions buttons are not used but right click with pop up menu
Interactivity	Tracking of navigation	The path through which the user navigates will be highlighted using a different color in the map (nodes and links)
	Mouseover( ) actions	Mouse over text as well as image also considered (messages, images, URLs etc.,)
	Simple Animations • Hide nodes • Expand nodes	When the size of the map grows, the hide node and expand node actions etc.,
	Drag and Drop option	Functionality that enables the user to drag and drop the map anywhere inside the canvas.
	Text Manipulation	Font size, style and color and others
Storage format	JSON array structure	Light weight but fast accessible format
Work Environment	Online (Internet/Intranet)	Web application

Another feature identified is dynamic resizing of the map, i.e. the map must accommodate more number of nodes in restricted canvas size and allow the user to navigate easily within the canvas.Few requirements are collected from the students during the brainstorming sessions that were conducted initially. The students wanted the tool as online tool thus can be accessed anytime from anyplace. Another feature considered is portability which is also considered. Several possibilities exist for achieving the desired portability.

In order to document the identified requirements, simple procedures are developed based on standard software engineering guidelines.The identified functionalities are recorded as functional requirements of the tool and a detailed software requirements specification (SRS) is prepared.

IV. Architectural Design of CmapEditor

Generally, an architectural is essential for the successful implementation of any software development activity. Wikipedia [8] quotes the description of Clements *et al.*, on software architecture as "the high level structures of a software system". A three tier architecture is developed which is presented below in Figure 1. The following elements were considered for inclusion into the architecture: the database server, the client application and the application server.

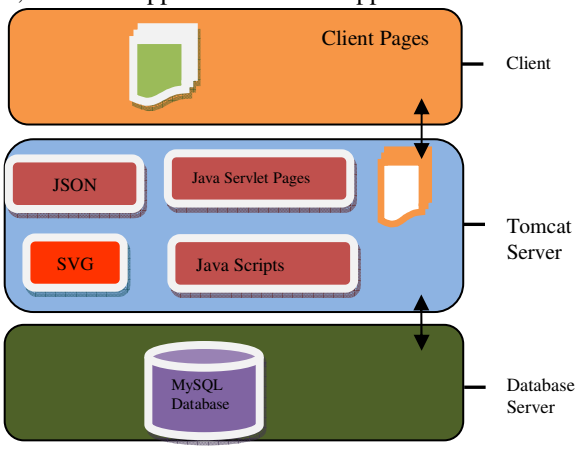

Figure 1. Three tier architecture of CmapEditor

The architecture is implemented by using the following elements: Eclipse Juno, Apache Tomcat, MySQL, Java Server Pages (JSP) and Java Scripts(JS). Apache was chosen as web server which is a container of servlets. A servlet is a small Java interface, which runs within a web server. Servlets receive clients' requests and respond to them across Hyper Text Transfer Protocol. The servlets can respond to any type of request and they are commonly used to run the web applications of Web servers. Apache also supports PHP and MySQL for web applications to be hosted. MySQL supports JSON as a data type thus enabling the tool to store the contents of the map as JSON array elements.

The node –arc type maps neee bds a hierarchical JSON data structure [4,5]. The JSON is used in web applications to represent data in various styles such as arrays, arrays with objects, objects with nested arrays etc. A schema is needed to handle different types of usage of JSON technically. A custom JSON schema is defined for this tool which is presented below in Table 2.

It presents the definition of a JSON data structure which is used as a schema to represent the nodes, relations, hierarchical levels, submissive concepts and path information. The data from the interface are directly stored into the database as JSON array. Viewmap() function will fetch the corresponding JSON

data and then draw the map for the user to view. With support for nested arrays and objects, JSON can be used to create custom and flexible schemas that needed to store and transport data in a way based on the needs. It is convenient to use a flexible format that isn't restrained by a two-dimensional, table-oriented paradigm.

TABLE 2. JSON SCHEMA & CUSTOM SCHEMA DESIGNED FOR CMAPEDITOR

Simple object	Custom JSON scehma for Concept Map

newObject = {
first: "Jimmy",
last: "James",
age: 29,
sex: "M",
salary: 63000,
registered: false
}
	var jSon = {
	id: 'node1',
	name: '',
	rel: '',
	children:0,
	step: 1,
	path: 1,
	nodes: [ ]
	};

V. IMPLEMENTATIOB OF CMAPEDITOR

As discussed, the *CmapEditor* was developed to provide the basic functionalities needed to create and manage concept maps. The functionalities such as add node, add relationship, change node name, change relation name, remove node, remove relation and save are implemented. As mentioned eariler, the *CmapEditor* was implemented using JS, JSP and MySQL technologies. Further, the editor was designed to have the advanced user interface techniques like drag and drop of objects in the canvas. The interactive features like hiding the nodes , expanding the nodes were implemented as they make *CmapEditor* as special one. For example, if the map contains three child nodes under the root node and if the user is navigating through the first child node, then the child nodes of other two nodes are hidden. This enables the user to have a comfortable view of the nodes and links of the map.

Below are features that were incorporated into the CmapEditor.

- No standard menus and buttons
- Context Menu to create and manipulate maps
- Quick display of maps
- Customization functions (brightness, shape and color and etc.,)
- Simple animated features like Hide/expand nodes and Drag
- Supports to text, image and other features (mouse over message, embedding images /url etc.,)

A screen shot taken while creating a map using the CmapEditor is presented in Figure 2.

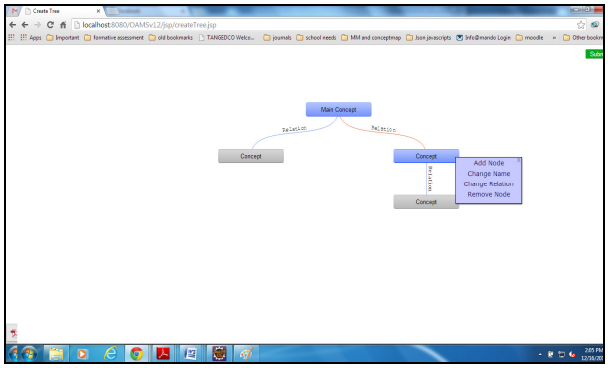

Figure 2. A screen shot taken while creating a map using the CmapEditor

A canvas is created as drawing area where the map is drawn in for this purpose and a Scalable Vector Graphics (SVG) object, a Rounded Rectangle, was chosen for repreesenting nodes of the map and a directed link(arc) drawn to connect the nodes. These objects are defined as dynamic objects as the number of node increases the nodes will be reorganised dynamically (repositioning the map in the canvas)

A screen shot of the concept map created using the JSON structure and SVG objects is shown in the Figure.3.

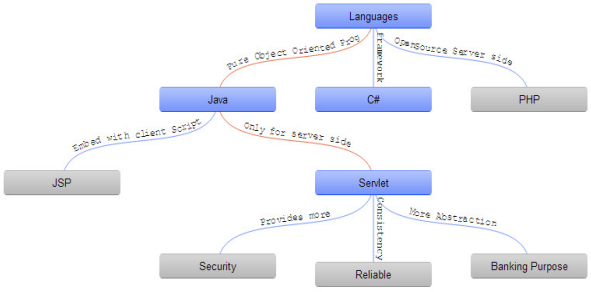

Figure 3. Screenshot of CmapEditor displaying the map created

The standard software testing techniques were involved to verify and validate the tool. Necessary changes were made based on the reports of different test cases.

VI. EVALUATION OF CMAPEDITOR

To evaluate the implemented CmapEditor, a study was carried out with 36 post graduate students from fourth semester. The students have prior experience in using the concept maps and concept mapping tools in their learning and assessment activities. All 36 students practiced concept mapping for a course by name Software Engineering. The methodology used is composed of a survey questionnaire and evaluation based on the use requirements. This methodology was chosen because this experiment involved purposive sampling (Patton) of students. This experiment design involves the definition of a hypothesis that is tested using the selected purposive sampling group. The students were introduced with the CmapEditor and were given enough training to practice the tool. Then, the students were asked to use the tool during their learning and assessment activities. At the end of the practice, the students were issued with a survey questionnaire. The question items in the questionnaire were developed in way that obtain the views of the students about the functionalities of the tool such as the

interactive features, editing of map, access to the map (i.e. storing/ loading of maps to/from the storage). At the end of the survey administration the data were analyzed using probabilistic techniques to validate the initial hypothesis. The hypothesis for this experiment is as follows: "The students value the use of CmapEditor as a simple interactive concept mapping tool". From such a hypothesis, a dependent variable is defined: "The impact of the use of CmapEditor for concept mapping". To ensure this a survey questionnaire was circulated to the students. The questionnaire followed a five point Likert scale levels i.e. 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.

Table.3 shows the question items developed for the survey questionnaire along with the responses from the students (in percentile).

TABLE 3. SURVEY QUESTION ITEMS WITH RESPONSES

Sl. No.	Question Item	SD	DA	NTL	A	SA
1	CmapEditor's interactive features are very useful	0.0	2.8	5.6	44.4	47.2
2	I like the new interactive CmapEditor very much	0.0	0.0	8.3	33.3	58.3
3	I can track my navigation path in the map	0.0	5.6	2.8	61.0	30.6
4	Interactive CmapEditor helped me to do concept mapping quickly	0.0	2.8	8.3	52.8	36.1
5	The CmapEditor loads the concept maps quickly	0.0	5.6	8.3	47.2	38.9

The survey questionnaires were circulated to all the students and collected back. The responses of the students were analyzed using simple statistical measure mean. The mean value of the individual question items were 4.4, 4.3, 4.1, 4.1 and 4.1 respectively. This shows that the CmapEditor created a positive impact among the students who used it during the experiment. Figure.4 visualizes the survey results as graph. Out of 36 students about 91.6 % of the students have agreed/strongly agreed that the interactive features are useful, in addition to this about 5.6 % students have recorded neutrality for the same item while 2.8 % did not agree that the interactive tool was useful.

The second item was to obtain the view of the students whether they like the tool or not. For this 91.6 students responded positively while 8.3 expressed their neutrality. The third item was about the track path feature of the tool. About 91.6 % students agreed or strongly agreed and 5.6 responded negatively. Further 2.8 % of the students have expressed their neutrality for this item. 88.9 % students agreed or strongly agree that the tool helped them to create the map quickly. 8.3% of the entirety shown neutrality while 2.8 % responded negatively.

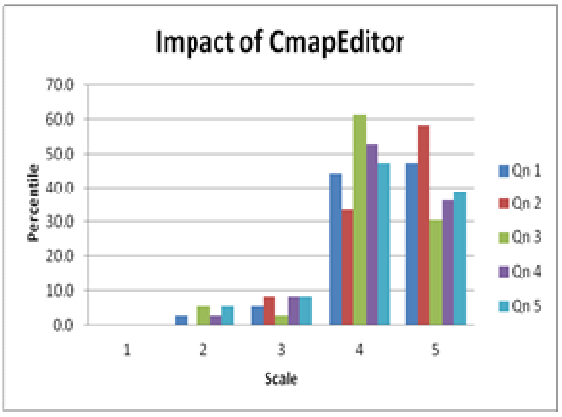

Figure 4 . Students' view on the impact of CmapEditor

The fifth item was to obtain the feedback on performance of the CmapEditor especially in loading the maps. For this 86.1 % of the students positively responded while 5.6 % students responded negatively. At the same time 8.3 % of students expressed neutrality for this item. Overall, the results showed that the CmapEditor had created a positive impact among the students an interactive concept mapping tool. Hence, The hypothesis is accepted as the result of the survey is favorable towards a positive impact among the students. It is observed that most of the students were appreciating the interactive features in viewing the maps and therefore, it can be affirmed that the hypothesis is correct.

To support this conclusion, an opinion statement was posed to the students. This assertion was: "After using the CmapEditor, I believe that interactive concept mapping tool like this, makes it easy for me to create and manipulate concept maps. Therefore, I prefer CmapEditor for concept mapping and it is more attractive, in my opinion". A total of above 90% of the students agree with this assertion and consider it useful. Several semi-structured interviews were conducted to take into account the educatorss' opinions. During these interviews, the system is presented to them, and their opinions were elicited. The results show that 77% of the educatos agree with the functionalities of CmapEditor improve student participation and enrich learning. The other 23% believe that it may not easy to involve concept mapping (CmapEditor) for all courses.

VII. Conclusion

A JavaScript and JSON based online concept mapping software tool – CmapEditor is designed and developed. The interactive features are very useful in motivating students as they get excited while navigating through nodes of map. By using JSON based maps, CmapEditor provides a better support to higher education setups that uses concept maps to create, share and assess knowledge. Further to this, the tool was evaluated based on the impact created by the tool using a survery questionaire and semi interviews with educators and students. Although the results of the preliminary evaluation are favourable, it would be interesting to explore new research avenues in future that focus on 1) including JSON based CMs into the teaching-learning processes, new possibilities for

visualization and inspection of knowledge can be explored in order to improve the teaching-learning process, 2) further evaluation with all stake holders and 3) on the integration of CmapEditor into Modern Learning Management Systems.

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Enriching Learning Process by Gamifying Electronic Exam

Ahmad A. Kardan, Ali Kazemi-Arani

***Abstract*—In this work, the detail about gamifying the online exams are described. Features of this work obtained from game features to make students feel that they are playing a game. The constraints of the gamified exam and new tools which are added to the traditional online exam are introduced. In addition, the reasons for defining rewards or trophies are explained.**

***Index Terms*—Electronic Exam, Gamification, Learning**

I. Introduction

FROM 25 years ago until now, we tried to develop education with entertainment, and the majority of studies focused on children. To date, creating a festive and fun atmosphere for all ages was noticed [1]. The concept of gamification has been used in various fields since 2010 when it is introduced, and quickly became widespread [2], [3]. In the field of education, a many works have been done and they tried to increase the engagement of the students by using games' features such as Awards and Leaderboard. For example, in the work by Berkling & Thomas [4], a map is provided for students to show their progress on the map, and a sense of playing a game is induced to motivate them. Gamification's main goal is to raise the engagement of users by using game-like techniques such as scoreboards and personalized fast feedback [5], and making people feel more responsible and purpose when engaging with tasks [6]. One of the features of the gamification is to increase user productivity [7], and also using gamified process, will cause partners to be aware of the progress of activities in other parts of the organization [8]. Although many studies have been done on education, there is a little study on the e-exams and gamification and they tried to increase students' motivation through using a trophy and Leaderboard system. In this study, it will be shown that by using a unique game element, namely hints, how it is possible to add new features to e-exams and make them a tool which help students in learning and transfer knowledge to them in addition to the assessment.

II. Gamifying Electronic Exams

One of the problems which exist in traditional exams is they only used for assessment of students. Also, some students due to high stress, cannot show their knowledge perfectly at the examination time, and the obtained results would not be the real results [9] and they may have the knowledge but because of the exam's stress they cannot answer the exam questions. On the other hand, if students during taking exams feel that they are playing a game, their stress can be descended. Consequently, when students taking the exam with low stress we can convey the proper knowledge to them and add the learning feature to the exam which used to be an assessing tool only.

For gamifying exams, game features and techniques must be used and be embedded to the traditional exam. One of the most important features of the games is giving rewards to the student after reaching to the predefined goal. Rewards should not be easily attainable, and should be achieved in such a way that always motivates students [10], [11]. Before defining the goals for getting rewards, it is vital to defining rules and constraints. Therefore, at first the constraints and rules will be explained and then rewards and the reasons for their existence will be introduced.

E-exams in this study are taken through the internet and students answer the questions in their home. No limitation in using books and time is considered for increasing students' motivation to study and also hints contain proper knowledge for students and these hints change a gamified e-exams to a tool for learning. Also, these exams were little exams which held during the second half of the school year. These e-exams held on mathematics and literature courses, and this gamified e-exams make the opportunity to gamify all the e-exams for other courses.

A. Rules and Constraints

In this work, gamifying exam is based on teamwork. Thus, students divided into the 5 team and each team had 5 players. Members of the team selected based on their scores and records in the class. Designed questions in gamified exams have 4 hints, and each exam has 5 questions. In these gamified exams, students must earn scores to get rewards. In addition, scores are in 2 types; personal scores and team scores.

Every action on the questions, other than selecting the correct answer, will reduce the score of that question. Actions in addition to the answering, are passing and using hints. Students are able to pass maximum 2 questions from 5 to their teammates and get a little score from that question and if the pass receiver selects the correct answer, in total they will roughly earn the maximum score. Also, using each hint will reduce the score of the question. Considering hints in gamified exams cause students to learn the related knowledge to that question and do their effort to answer the question with that hint. In the table I the actions and the related score are shown. Using hints will reduce the potential point of the questions and students only can earn points if they select the correct answer or pass the questions.

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TABLE I
SCORES OF ACTIONS FOR EACH QUESTION.

Action	Personal score	Team score
Correct answer (Maximum score)	24	7
Passing	8	1
Correct answer to passed question	15	5
Correct answer after using 1 hint	12	5
Correct answer after using 2 hints	8	5
Correct answer after using 3 hints	5	5
Correct answer after using 4 hints	2	1

According to the number of questions in each exam (5 questions), each exam will bring maximum 120 personal scores and 35 team score for students. In following, the rewards and their description are explained. Team scores calculated by adding each team-members' team score. So, the maximum team score is 175 which means each 5 team member should get 35 points.

B. Rewards

As mentioned before, the rewards must be defined based on goals. According to our goal which is enhancing learning during exams, gamified exams must force students to try their best and if they could not find the correct answer students are able to use hints and again try to answer the questions. Consequently, rewards defined as shown in table II. These rewards called as ***Static Trophies***. If students earn this type of rewards, they will never lose it in the future. Five of these rewards determined based on the scores and encourage students to earn the highest score as they could.

As it is clear, two top rewards, with a crown shape, can be earned only if they get the maximum score. Earning these rewards make a challenge for students, which is an important element in gamification and it will motivate them. Also, the last individual reward which is given to the top 3 students in each exam is determined to increase the motivation of the students because in each exam they are able to be in top students and prove their excellence to others.

TABLE II
STATIC TROPHIES OF GAMIFIED EXAMS

Static trophies	
Individual	**Team**
	
If at least 120 scores be earned	**If at least 175 scores be earned**
	
If at least 90 scores be earned	**If at least 140 scores be earned**

Static trophies	
Individual	**Team**
	
If being the top three students in each exam	**If at least 125 scores be earned**

Another type of rewards is ***Dynamic Trophies***. Students and teams can lose these rewards if they are in lower than 3 in ranking. These rewards determined to motivate top students and top teams, and make them compete with each other. Dynamic Trophies are shown in table III.

TABLE III
DYNAMIC TROPHIES OF GAMIFIED EXAMS

Dynamic trophies	
Individual	**Team**
	
If being the first top student in total exams	**If being the first top team in total exams**
	
If being the second top student in total exams	**If being the second top team in total exams**
	
If being the third top student in total exams	**If being the third top team in total exams**

Fig. 1. The image of the Leaderboard of this work which presents top teams at the first table and top students in the second table. The ranking of students and their team are shown by different color.

C. *Leaderboard*

One of the indispensable features of games and gamified processes is Leaderboard [12]. Ranking students and comparing them cause students to know their place in comparison with other students. So, they will try to go higher in rank and compete with others or the exact student. Also, ranking team makes students feel more responsible for doing their exam and try to get the best result. In Fig. 1 the example of the Leaderboard of this work is shown. The rank of the current student showing in a different color. The first Leaderboard is team ranking and the second one is students ranking. Leaderboards show the whole earned scores in both courses. These Leaderboards will not be cleared until the end of the school year.

III. Summary and Conclusion

To date, many works have been done about gamification in education. In this work, we explained the details of a gamified exam and describe all constraints and rewards. Also, it has been shown that how e-exams can be a part of the learning process by using the gamification in an appropriate approach. In addition, gamification elements make a better atmosphere for transferring knowledge to students. For instance, rewards determined based on the learning goal and tried to increase the motivation of the students. Also, some rewards considered to attract them to try their best, whatever they are in best rank or lower rank. In addition, Leaderboard makes students to compete with each other and try to defeat their opponent. In this gamified exam, students tend to do more exams in this gamified exam and it shows they had good motivation for taking exams. Also, in the final exams they earned better scores in comparing with the students which did not use the gamified e-exam. In this study, all students had a proper skill in using computers and the internet, but a potential problem which needs more study is that students with lower skill in using a computer can decrease their motivation and it is an obstacle in this such works.

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