

Moving towards a paperless classroom: Strategies in effective uses of computer based student data

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Currently most universities throughout world expect students to either own or have access to computers (via campus computer labs). Likewise most academic work submitted by students is created on a computer and more often than not, printed out then handed in. However, recently a growing number of teachers and curriculums have adopted electronic methods of student assignment submission. Many programs and instructors undertake such methods for number of reasons, the most common being the collection, correction and storage of student data and work, reducing departmental costs and the ease of accessibility for both students and teachers (Keller 2001, Furr 2003). Still, the number of true paperless classrooms, while ever increasing, is quite low.

This paper examines the methods and benefits of collecting all student assignments electronically and offers guidelines on how to make effectual use of such documents in order to facilitate better organization, instruction and feedback on the teacher's part, peer and teacher interaction on the student's part, and finally, the use of collected student data in lesson planning and material development. In doing this, it is hoped that more programs and instructors will adapt primarily electronic based methods of assignment collection. While this paper uses the EFL classroom as a model for many of the discussions and examples, the ideology and methodology used within this paper are easily applicable to most primarily written assignment based courses and curriculums.

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1. Methods of collecting electronic assignments from students

1.1 Factors affecting data collection system implementation

The first step in beginning to switch to a primarily computer based document submission system is to create an organized method of collecting data. Later this paper will discuss some of the more popular systems of data collection, however before going into the specifics of such systems it is important to identify the various factors to consider when deciding which approach or mixture of approaches of data collection is best for a given program or classroom. The first factor to consider is the ease of use for teachers and students. Systems which require undo amounts of time to learn for teachers can end up being more hassle than their worth such as times when computer errors or problems occur and the teacher is unable to troubleshoot or otherwise resolve the problem thus interfering with classroom time and or mechanics. Similarly, if students are unable to understand or properly use the interface of a data collection system it may hinder them from successfully submitting completed assignments.

The second factor to consider in deciding on an appropriate data collection system is its collection and organizational capabilities. This is significant in terms of what type of data it accepts in terms of text, word-processing or multimedia files. Likewise some forms of data collection have limits in the maximum amount of data that can be submitted or transferred in a given session. Again, with most word processing files this is not a noticeable problem; however some video or audio files can exceed 100 megabytes in size and may be impossible to submit depending on the type of data collection used. In terms of organization, it should be considered whether a given data collection system automatically organizes specific files into folders based on class and/or particular assignment or whether the teacher must submit files individually and categorize them manually.

Ease of access to a data collection system is another important feature to consider. Some methods allow for students to submit files from anywhere at anytime via use of the internet, while others are more restrictive. The use of a more open system provides students with complete freedom to turn in their assignments when and where they please. This allows teachers to set submission deadlines independent of class meeting times and involves a higher level of student accountability, as students must remember when a given assignment is due. A more restrictive system can also be valuable in classroom management and student accountability. Some systems have strict deadlines, which if not met, do not allow for late submission of files. Others have features that can be used as a means of keeping attendance or insuring files only from certain computers or logins are accepted.

A final factor in determining a proper data collection system is its monetary cost and any implementation limits it may have in a given classroom or curriculum. Naturally, the

most important issue to consider here is the availability of interlinked (via internet or LAN) computers to teachers and more importantly students. In terms of students, if computer access is limited strictly to an in-class computer lab naturally the time in which computer based assignments can be worked on will be much less than a curriculum where all students have access to computers outside of class time (via personal computers). From an instructor's side, program budget restrictions may limit the amount of data collection systems which can be purchased by a teacher. In some other cases, school contracts and obligations may govern the software that can be installed on "school computers" thus limiting the teacher's choices in terms of deciding on a data collection system.

1.2 An assessment of data collection systems

Depending on the needs and budget of the program or classroom as well as the existence of computers or a computer lab in the classroom or on campus there are three primary approaches in which to use to collect data from students. The first, and most familiar to a majority of teachers and students involves using email to submit documents. Another approach involves setting up a local area network (or LAN) in a classroom or campus where students and teachers can easily exchange computer files in an organized and easily viewed manner. Finally the use virtual classroom management programs such as *Blackboard* and *Nicenet* mix both the off-campus easy access benefits of using e-mail with organization advantages similar or exceeding a LAN based system. However, such programs may do so at a cost of either functionality or capital. This section of the paper will discuss the advantages and drawbacks of these three data collection systems.

Email is perhaps the most common and widely used a data collection system. It has already become a normality of academic life. Most universities and even some high schools and junior high schools require and assign school e-mail addresses to all students. Likewise many teachers and students use e-mail channels for communication given that it allows non-real-time virtual 24 hour office hours. Implementing e-mail as a data collection system can be done quite easily. Messages or even papers can easily be typed and sent to teachers at the student's leisure. When considering data collection and organization however, e-mail is highly inefficient as teachers must match up student addresses with names/student numbers and particular assignments. In addition, for attached files the teacher must go through the time consuming process of individually downloading and organizing assignments. Likewise many e-mail systems have a maximum file limit size which may prevent students (and teachers) without high technical knowledge from sending and receiving heavy data files. When considering ease of access, e-mail again rates high, with most systems allowing students and teachers to access e-mail from anywhere where they have an internet connection (and

in some cases through the use of cell phones). Creating e-mailing lists also allows teachers to effectively communicate with an entire class without time or place restrictions (though not in real time). E-mail is also a great system to consider when adding in cost factors, as it is provided free by most school systems or free high storage capacity e-mail accounts such as *Hotmail*, *Yahoo-mail* or *Gmail* are readily available.

Another popular system of student data collection involves using a system of connected computers or Local Area Network (LAN). Such systems involve setting up a hierarchy where instructors can control toggle access to available and submitted data and files. In their simplest versions LANs often have shared drives or folders which instructors and students can access. Some of these can be locked with password or computer access allowing teachers collect or distribute assignments for particular students or classes. More advanced solutions include using programs such as *Vision* or Sony's (currently Japan only) *Wingnet* to take the LAN a step further. These programs allow teachers to send files, text, audio or chat with particular students, distribute multimedia files, view or take control of student's computer screens, collect attendance and most importantly automatically format and organize particular assignments so that all sent files for a given assignment will be automatically collected and placed in easily accessible folders which can later be viewed and or modified. Realistically speaking, most schools that make use of LANs have a predefined program which all teachers are expected to use. However in smaller situations, such as computer labs teachers may have the option to choose software which best suits their needs.

Looking at LAN systems in terms of ease of use depends heavily on the particulars of the system being used. Most school LAN systems will have technicians to help teachers and students learn the basics of a LAN system. Similarly many available programs concentrate on ease of use for teachers and students as a sales point and, while teachers will generally have more to learn as a classroom manager the overall investment in time spent learning a program is worth it in a long-term perspective. That said, given the computer experience and knowledge of a given instructor many purchasable LAN software programs may be more user friendly for the less tech savvy teacher. As noted previously LAN systems can excel in efficient and highly organized data collection. Even with the simplest of LANs teachers can easily create and title folders for students to submit specific assignments to.

In terms of ease of access, there are two major patterns in LANs: Smaller LANs will be restricted to a particular room (such as a computer lab) while school wide LANs may allow for students to access them from anywhere on campus. In terms of cost setting up a LAN can be expensive depending on speed and software used. Obviously there is the cost of basic computers to be considered when designing a LAN. In addition other costs will include materials for linking the computers and the use of LAN software and/or technicians. However, usually once in place there is no need to pay additional fees to

support an up and running LAN (Naturally, barring wear and tear on the equipment). While LAN systems may not offer the ease of access or use of e-mail they are far superior in classroom management and organized data collections, which in the end can save both instructors and students a lot of time.

Virtual classroom management programs offer the convenience of e-mail in that many can be accessed from anywhere given an internet connection and a password, as well as organization capabilities which can exceed even the best of purchasable LAN software as many allow students and teachers the freedom of having full web based classes with features such as online chat, blogging, and advanced control over shared online folders and assignment collection and distribution. Other common features include automated e-mails sent out to students reminding them about deadlines or informing them of scores in the form of template progress reports. Increased use of such programs, especially in the K-12 range has lead growing number software companies to create online classroom management programs, with there now being roughly 50 odd popular programs on the market.

With such a large variety of programs to choose from, finding the right one for a given curriculum can be a difficult task. That considered, this paper would highly recommend the web site *www.edutools.info..* This site gives a detailed and accurate list of features for each program with links and allows for comments and reviews from program users. Additionally a built in search engine allows one to filter programs by rating, price (including a list of free programs) or other features.

While it may be impossible to accurately measure all virtual classroom programs in ease of use, most of these programs (particularly those that sell well) are aimed providing an easy to use interface for instructors and program coordinators. Naturally the more one wishes to do with a program the more technical knowledge is needed. However, since most virtual classroom programs are driven by capitalistic intentions most have customer support available, and some even offer free training for staff when larger purchases are made. Similarly the collection and organizational capabilities of virtual classroom programs while various, tend to be equal to or superior to LAN driven classroom systems. In addition to allowing time limits and late turn in limits for assignments many programs also give automated responses signifying successful uploading of data. Variances aside, nearly all virtual classroom programs allow for easier collection of student data when compared with e-mail. A particularly nice feature involved with virtual classroom programs is that they all store collected data online which not only provides an increased ease of access, but also safeguards the data against accident, which ensures student data won't become lost or mistakenly deleted. In addition many purchased programs also offer discounts or free upgrades to newer versions of the program. In terms of cost programs vary from being freeware to running thousands of dollars for large programs.

	Email	LAN	Virtual Classroom
Ease of use	Very simple	Variable: Requires tech knowledge / support with emphasis on setup.	Variable: Most designed for ease of use and have customer support.
Collection and Organization	Poor	Good	Good - Excellent
Accessibility	Anywhere with internet access.	Limited to computer lab or campus.	Anywhere with internet access.
Cost	Free	Low – mid	Free – high

Figure 1: Comparison of data collection systems

As mentioned before and shown in figure 1 below, when considering a data collection system an instructor must balance usability, functionality, accessibility, budget constraints and personal preference. Furthermore, there is no need to limit a classroom to one system. Circumstances and reality will more often than not demand for the need of a backup system or alternative system in case of emergencies. Much as is true with teaching and given the high rate of computer based technological development becoming fossilized in the use of a particular system only serves to limit both teachers and students.

2. Organization of collected materials

After having decided upon an effective strategy for collecting student assignments, an ordered method of organizing gathered student data should be employed. The primary factor governing an organization system here is based on whether or not a software program also has a built in data organization system (*Blackboard* being a prime example). This section of the paper will assume no such program was used for data collection, given that it would be unreasonable to consider all the discrepancies between different programs. Instead it will focus on the importance of developing an efficient student data organizational method using order of folders and *Microsoft Excel* or a similar database program.

The key point in organizing student folders is to aim for simplicity and efficiency. In organizing my own student data folders I keep one primary folder which holds all student data. Within the primary folder are two sub-folders; one for the current semester and one for all previously collected data. This allows for easy access to current and recent material since that is the material most often used in a given semester. Within the current semester folder, subfolders are divided by class taught, and within those folders by individual student names. While this system may be slightly time consuming to set up, ultimately it provides an excellent system which allows for easy access and recording of data. At the end of a semester the “current semester” folder is

re-titled based on term and year and put into the “previously collected data” folder. Finally, though not recommended for computers without large storage space, creating a folder for repeating students in the previously collected data folder (making sure to sort folders within an individual student’s folder by class/semester) can be helpful in that it allows an instructor to easily glimpse all of a student’s previous work, which in turn can prove to be useful in long term assessment and guidance.

Simple modifications of downloaded *Microsoft Excel* grade book templates (see Appendix for link locations) when combined with an organized folder system can serve to create an extremely efficient and organized system of collected student data, easily accessed for assessment, writing letters of recommendation, materials development and research. Figure 2 below demonstrates a modified version of the basic percentage weighted grade template available on Microsoft’s homepage. In addition to grade data, and when looking at long term assessment and development over the course of multiple courses, it is useful to add sections detailing a student’s overall strengths and weaknesses. In addition creating a notes section for each student allows an instructor to keep track of personal information such as medical problems or other pertinent information. This is especially useful when dealing with writing letters of recommendation and in keeping track of semi-personal information which can prove to be invaluable for keeping good relations with repeating students or those in need of letters of recommendation.

Name	Student ID	Score	Strengths	Weaknesses	Notes	Student files	email
Kugimoto	11	93	talkative, good le	makes assumptions	likes music	C:\Collected Work\Fa	kugimoto@stu
Suzuki	12	76	good reader	listening	wants to be	C:\Collected Work\Fa	Suzuki@stude
Yamada	13	68	essay writing	often late, little conf	class clown	C:\Collected Work\Fa	Yamada@Stuc

Figure 2: Modified Excel Grade Book Work Sheet

Figure 2 also has a column with students’ email addresses for quick and easy contact and which is also useful for creating quick class mailing lists. Most important to note however is the addition of an inserted hyperlink (under the “Student files” header) to the student’s collected data folder for a given class/semester. This gives the instructor instant access to all students’ submitted data for a particular course (and can easily be modified to link to previous data as well for repeating students) and can save the instructor vast amounts of time and effort when assessing or providing feedback for students.

This section of the paper illustrated methodology and reason for creating a well organized system for collecting and cataloguing submitted student data. However, as with all computer data it is important to point out the limitations of keeping electronic files. In relying on a primarily electronic method of data collection the instructor must be sure to protect themselves via keeping virus protection software installed and

updated on any computer which they use to calculate grades and more importantly by regularly making backups of all their collected student data. Recently flash memory USB sticks (which act much like larger floppy disks) are available in one and two gigabyte sizes. These allow for quick transfer of large amounts of data. It is advantageous to keep data updated as much as possible. It is recommended to keep two memory sticks one for the office and one for home to assure data safety. A final perk of collecting data which is stored online or in a LAN system is that it allows teachers to review or download the data at any time as long as it is stored. If for some reason, recently collected and/or assessed data is lost or destroyed, the unmodified original student data is easily available again. Thus compared to paper based modes of data collection and storage, this allows the instructor to quickly and easily duplicate entire histories of data, saving space, time and funds.

3. Effective instruction and feedback methodology

In addition to the organizational benefits of collecting student assignments electronically, computer based student assignments also allow for more effective methods of feedback than traditional paper based ones. Robb (97) has written an excellent guide on giving feedback via the use of word processing programs. This section of the paper will briefly review the standards set down by Robb and comment on them in light of the better word-processing technology available today, then go on to explore the further benefits of collecting computer based student assignments in pretence to pedagogical methodology and benefits to students.

3.1 An analysis and review of Robb's six approaches to electronic feedback

Robb notes six different primary approaches to giving feedback on student writing via word processing programs. The first method mentioned is the Color approach, in which the color of the problem text is changed in accordance with a pre-defined list of error types (Robb notes red for syntax, green for vocabulary problems, blue for logic/coherence/structure problems and pink for instructor feedback.). This allows for students to easily notice and correct problems when revising their essays. At the time of his writing Robb commented that the limitations of this method require all student to posses color monitors and that multiple problems in the same sentence would be impossible to properly note. However, with improvements in technology these problems are addressed. Firstly, monochrome computer monitors have been virtually non-existent since the millennium. In regards to marking multiple errors contained within the same sentence or phrase this can be easily countered using a change to font color coupled with the highlight feature, this allows a teacher to mark two possible problems in the same set of words. While still somewhat limiting in that only two simultaneous

problems can be marked, this system is however still effective in that any sentence containing syntactical, vocabulary and coherence problems together should warrant more teacher feedback than a simple change of color or underline in the case of paper based feedback. Overall, since the Color approach does not change or otherwise mark student text outside of tinting, it is a highly effective approach in that it allows the student to review errors without disturbing the continuity of their writing.

The second approach Robb states is to use a Style approach in which items are bolded, underlined, italicized or changed in font size to address the same line of problems the Color approach covers. The benefits mentioned here is that the Style approach addresses the original problems of the Color Approach in that allows for students without color monitors to view comments and allows for multiple marking of the same utterance. However, as stated above neither problem holds much significance with modern word processor programs. Furthermore, use of the Style approach may serve to hinder or confuse students as they progress in their writing careers. Both *MLA* and *APA* styles make use of bolding, underlining and italicization, as a result students who become used to seeing style markers used for error correction may have difficulties when they encounter them at a later date. Thus when considering advances in technology as well as students' long term writing careers the Style approach holds little validity in effective teacher feedback methodology today.

The third approach mentioned by Robb, and further examined by Wagner (97) is the Annotation approach where in the teacher inserts comments viewable in a separate pop-up window into the student's paper. The original writing with annotations may also be inserted into this window. This allows for the continuity of the comments to remain undisturbed as well as the original text itself. There are three primary problems with this approach, in that it requires some degree of technical knowledge on the students' side on how to properly move and remove such comments since revisions and corrections to writing may result in the comment box being moved to an inappropriate place or unwittingly deleted. In addition, if students should wish to print out their essay with comments on it, essays with large comment boxes will many times not print properly. On a final note, comment boxes are not as easily copied and pasted and moved around as other forms of feedback, thus teachers will have to be attentive to note that the comment is in the appropriate place in the writing when made.

The next approach Robb mentions is the Graphic-layer approach. The Graphic-layer approach simply makes use of *WordArt* or other imbedded word processor drawing program to make comments much as a teacher would with a pen on a paper based assignment. Realistically, however this requires teachers to not only have a good mouse-hand in that circles and arrows must be properly placed over proper words, but also takes time in that the art object must be properly layered to make sure it doesn't cover up or obscure any of the student's writing making it overall an inefficient system.

Robb also makes note of a Hidden text approach wherein the teacher can write in white colored text, signify comments with an asterisk and have students highlight the hidden text with their mouse to reveal it. While this approach arguably holds little in the way of feedback it can however be very useful in creating materials such as worksheets with built in answer keys at the end. It can also be used by students effectively to turn in semi-anonymous essays, wherein their names and student numbers are written in hidden text so that a teacher can assess writing without the bias of knowing which student wrote a particular essay until after it has been graded.

Finally Robb (97) notes the Interlinear approach as being where the teacher notes on the students writing directly below items being commented on. This can appear much like the use of the symbol '>' in emails and online bulletin boards or through the use of .all capital letters. Robb however finds problems in this method in that it often breaks apart continuity of students writing and that interlinear comments are occasionally unclear as to which aspect of the writing is being commented on. When compared to the advantages of using the Color approach with instructor marks made between paragraphs, or the Color approach coupled with the Annotation approach the Interlinear approach doesn't provide enough benefits to make it an effective choice for teacher feedback.

Many of the approaches set down by Robb in 1997 still hold validity today. Particular note should be given to the Color approach for its simplicity, ease and few disadvantages. Similarly, given the high level of technological aptitude of many students today the Annotation approach is excellent when making longer and more developed comments on students' writing. No matter what system is chosen, all forms of computer based feedback provide an additional advantage to instructors in that keeping assessed student files stored in their database for review instructors can gain insight into their own feedback style over time and use this knowledge to better meet their students' needs while making their own comments more efficient and successful.

3.2 Further advantages and techniques in computer based student feedback

In addition to the methods mentioned by Robb, there are additional strategies that can be employed to help in effectual student feedback as well as benefits that can be gained from dealing with computer based assignments. One system is the creation of a feedback template, which notes common errors such as lack of a title or proper introduction, when dealing with student writing. Many times when assessing student writing on a given assignment, teachers will encounter the same or similar problems throughout multiple students. Similarly, syntax and structure problems often repeat themselves across writing assignments. One advantage that a computer based medium allows is that instructors can copy and paste their comments into a new file for later use. By creating a feedback template for a given writing assignment the teacher can

save large amounts of time by pasting pre-written or previously used comments in writing when they are needed. Given the large amount of writing assignments that can be received in some classes this allows the teacher to focus more on comments tailored to aspects of a particular student's writing by eliminating much of the time and energy spent on common problems that occur throughout a batch of writing assignments.

A further advantage of computer based assignments is that, when compared with paper based feedback methods they can easily be changed. This is particularly useful in creating assessment reliability across a given assignment. For instance, if say on a computer generated writing quiz a teacher noticed that nearly all the students missed the same problem, therefore deeming it too difficult and deciding that no points would be deducted if the question was answered incorrectly. Using computer based assignments allows the teacher to easily go through already assessed items and change them as deemed necessary. This freedom to safely change or delete comments completely and without any indication to students of comments having been changed before giving them back to students allows for instructors to rethink their assessment system on a given assignment even after all assignments have been graded.

A final benefit to consider when collecting computer based assignments is that by keeping all previous student files the teacher creates a great safety net against plagiarism and passing down of papers across the years. Using the *Explorer* option in *Windows* the instructor can quickly search for blocks of text across multiple files. If, when assessing a particular assignment an instructor gets the feeling they might have read the same thing before they simply need to copy and paste a sentence into *Explorer* and search for it in their previous student files database. Similarly, blocks of text can also be pasted into popular internet search engines and searched for on the internet to determine if a student has plagiarized their writing from a source available online. Both methods allow for teachers to ensure students are presenting original work. Often simply telling the students the instructor has a full database of all previously turned in papers and will search online for any suspicious looking writing is enough to waylay any would be plagiarists.

3.3 Benefits to students

Many of the same techniques used by teachers for feedback can also be used by students in their writing. For instance when collecting essays from students the teacher can have the students make multiple copies their file. Copies can then be used as for peer reviews, wherein the students use one of the above approaches Robb (97) noted to make comments on essays. After peer reviews are finished students can then reflect on their peers' comments and alter the original copy of their essay to make a final version for submission. When submitted the student only need to turn in two files instead of one; their final version and their draft complete with peer comments. This

allows the teacher to record and examine the particulars of student peer feedback as well. Furthermore, since students don't have to be in the same place for the feedback to occur and since peer feedback can be submitted through data collection systems, valuable class time doesn't have to be used on peer review session.

Another point to consider when giving computer based assignments is that most all students will use word processor programs with built in dictionaries, thesauruses and grammar and spelling checkers. This can be advantageous as the programs can serve as a proactive warning tool allowing students to realize their mistakes before they turn their assignments in. However, students will often become too dependant on or trusting of these programs in lieu of self proofreading. It is important to demonstrate to students the flaws of using automated programs alone to check spelling and grammar. One such method of doing so is by demonstrating misses with phrases from previously collected assignments. Additionally, I have had great anecdotal success with showing the poem "An Ode to Spell Checker" (see Appendix) to students. Wherein computer based assignments provide many benefits to students, instructors must be careful to note that some students may rely too heavily on these programs and that they are in no way a substitute for developing good personal proofreading skills.

4. Materials development using computer based assignments

Another considerable benefit of using a computer based method for collecting and storing student assignments lies in both materials development and research. As noted above keeping a folder of all previously collected assignments provides the teacher with a huge source of examples of student work as well as teacher feedback on that work. In terms of materials development, teachers can easily and anonymously make use of previous student work to serve as examples or to be developed into worksheets for future students. By copying and pasting specific instances of frequently occurring mistakes or good examples of a particular point teachers can create better guidelines of what they expect from students for a given assignment.

Moreover, the teacher can also include their original comments on these examples so as students can gain some exposure to the instructor's feedback style. It is important to remember that teachers need not limit themselves to traditional writing assignments here. Answers to constructed response tests as well as *PowerPoint* presentation files can also serve as good examples of student generated work. Finally, using electronic student data instructors can compile data across semesters into larger text or word processor files, thus creating an effective student corpus for analysis.

Conclusion

With a growing number of paperless or primarily computer based classrooms coupled with the expectation of students to create written assignments with computers the need for instructors and programs to fully make use of the advantages technology has to offer them has risen. Efficient computer based assignment collection, storage, and correction methodology gives instructors many new tools to work with by providing them with the ability to quickly see and manipulate a large range and history of student data with minimal effort. Furthermore in analyzing both student work and teacher feedback this methodology also can present instructors with new insights into patterns over time for individual students or whole classes as well as give instructors themselves a more analytical view of their own teaching style. Even the use of computer based methods for collecting assignments in partially paperless classrooms can allow teachers better organization of student information and materials and a more detailed view of student work. Much the same as instructors must keep up to date on breakthroughs and techniques in their field; technology now plays an increasingly major role in the classroom and should be adapted as it allows more effectual methods of organization, instruction and feedback.

Appendix: Useful homepages for data collection and organization

- A list of downloadable *Excel* grade book templates:
http://www.edutools.info/group_list.jsp?pj=8&g=32
- A free downloadable weighted point scale excel template by Saint John's University:
http://www.csbsju.edu/itservices/teaching/Gradesheet/gradesheet_1-3_weighted.xls
- Edu-Tools homepage for product comparison and information for virtual classroom programs: <http://www.edutools.info/>
- Ode to spell checker Poem: <http://www.etni.org.il/farside/odetospell.htm>

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