Continous Learning Feedback

Shaping Teaching through Realtime Feedback

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Abstract — **In most situations where teaching is involved, the need for learner feedback is of utmost importance. Rhetorical theory of communication (concepts of aptum and kairos) underscores the significance of understanding foreknowledge (Gadamer). Since foreknowledge is by nature assessed prior to the learning experience and observed learning outcomes are assessed after the experience, a temporal gap in assessment is obvious. The aim of this paper is to suggest a method for observing learner attitudes, interests and level of learning in realtime during the learning experience. This is exemplified through the use of the Conceptual Pond application to facilitate an insight for the educator into the process of learning and immersion of the learner. Two use cases are discussed in detail as well as the consequences for teaching.**

Keywords- education; assessment; Conceptual Pond; kairos; aptum; continous

I. INTRODUCTION

Educators at every level of education know that one of the crucial points in achieving sustainable learning is recognizing the *scena* (audience) of the teaching event. Regardless of whether the teaching methods are traditional teaching in class rooms, technology enhanced learning, blended learning, or standalone online learning, the question still applies: Who is the recipient of my transference of knowledge and invocation of reflection? The identification of the potential the learner is a key issue in the research on cognitive styles [1].

The answer to this question seems straightforward as it may be an ideal for every educator to be thus informed. Nevertheless, this initial knowledge is only the tip of the iceberg as there may be growing level of knowledge, as well as a change in interest and reflection during the course of the learning activity. In this way, a temporal component adds to the complexity of knowing and understanding the cognitive position from which the learner is prone to receive learning. The Greek philosopher Heraclitus of Ephesus illuminates this temporal complexity by his *panta rhei* argument, *everything flows*, identifying the fact that one cannot immerse in the same river twice. Immersing in it once again it is not exactly the same river – and perhaps the person descending in the water is not even the same person.

It is therefore a great advantage for the educator to be able to monitor the progress of the learner in terms of knowledge throughout the learning process [2]. Sadly, this may often be difficult as traditional testing may disturb and interfere with the consistency of the planned learning process. Another interesting question is what kind of data is in fact beneficial for the educator in the course of teaching?

The aim of this paper is to discuss these issues and suggest a way of gathering feedback from the learner throughout the temporal learning process. Such a gathering is exemplified through using The Conceptual Pond assessment application [3] as a tool to aid the teacher in making intermediary, intuitive assessments in the course of a learning experience. Two specific use cases are presented and discussed.

At the same time it is obvious that the possibility for interim assessment in realtime, may influence the way in which teaching is prepared and performed, and what teaching aids may be helpful. Interactivity obviously is only of benefit to the learning experience if the schedule and/or content may in fact be adjusted according to the new knowledge of the educator. This will be discussed on the theoretical basis of the classic five *canons* of rhetoric [4].

Some important concepts and terms must be defined:

- Learning event or similar refers to a single session of learning or a short sequence leaving no temporal space for traditional assessment.
- Realtime assessment refers to the gathering of input with no notable delay (< 3 minutes or continuous).
- Teaching refers to any kind of educational practice involving a predefined timespan of learner attention.
- Feedback refers to any kind of input or expression conveying and exposing the interests and attitudes of the learner to the teacher.
- No distinction is made between learning / education or teacher / educator.

This paper is structured as follows: after the introduction (1) important aspects of the learning situation are presented (II) using a framework of rhetorical *aptum*. Subsequently, the element of feedback is discussed (III) leading to an analysis of the leaning situation implementing *kairos* theory (IV). The continuous learning feedback application is described (V) and two use cases are presented (VI) leading to reflections on consequences for teaching (VII) and a closing section (VIII) with concluding remarks and suggestions for further study.

II.   SHAPING THE LEARNING SITUATION

In the preparation phase of a learning event, multiple aspects are obviously taken into account by any educator. Referring to the classic *aptum* model (Figure 1.) for the appropriate formation of a communicative event may be illustrative in creating overview and suggesting terminology.

In this model, the *orator* is the transmitter of a message, in casu the teacher. Scena is the audience. *Situatio* depicts the communicative situation. *Res* is the matter or content of the communicative act. *Verba* is the actual expression or eloquent wording of the message. Though this model originates in pre-digital history it is suggested as a helpful model as it contains basic elements in communication [5] [6].
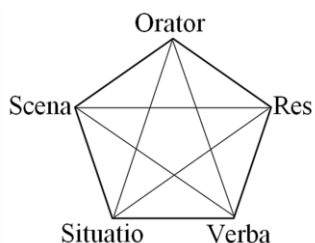

Figure 1.   The aptum model

In the pentagram model, there are two relations relevant to this paper: first, it is the relation between *orator* and *scena* and, second, the relation between *res* and *verba*. In the classic rhetorical situation of the persuasive, political, or judicial speech, the five aspects are generally fixed at the beginning of the communicative act. The sequence of the speech requires this. On the other hand, a sudden change in the expression of the *scena* may at one time influence the *orator* into altering the relationship between *res* and *verba* reformulating and reshaping the speech. This interdependency between the *aptum partes* allow for a dynamic development in the communicative processes.

Though rhetoric provides a helpful framework for the understanding of communicative processes, it is not a theory originally designed directly for learning purposes. Therefore, learning taxonomies are also an important part of understanding assessment and feedback [7].

The general structure of these taxonomies pictures an increasing level of knowledge, engagement, and reflection. This progress must be verified, as suggested in the shape of *Structure of Observed Learning Outcomes* (SOLO taxonomy) [8] leading the learner on the path towards increasing complexity from the *pre-structural* level through *unistructural* and *multistructural* levels to the *relational* level, where ownership of the learning process is achieved and further leading to an *extended abstract* level.

Though these steps may not be implemented fully in the paper, the progression of complexity, ownership and engagement is worth noting as goals for learning processes.

III.   FEEDBACK

Obviously, feedback has always been part of an educational process. In primary school, a teacher will most often ask for feedback from pupils in the form of raising their hands, selected pupils making a remark or in other ways making sure that the actual teaching makes sense for the recipients. In this broad understanding, the concept of interactivity in education has always been implemented.

Though this process of feedback, interactivity, or user input is unproblematic in a manageable physical learning environment, this is not the case in other contexts. In a learning scenario with 200 students the complexity of receiving traditional feedback from so many actors would create immense cognitive stress. At the same time, lectures would be prolonged indefinitely if each student should be allowed and encouraged to interact with the lecturer.

Since the reduction of complexity is necessary, approaches from the sustainable primary school example have often been implemented: The raising of hands or the comments from a small number of students that now represent a quite limited percentage of the students. At the same time, it may be questionable whether these students actually do represent the general interests and concerns of the collective of students. Psychological factors may discourage some students from raising issues in plenum and others may want to show off their understanding in order to impress the lecturer or others.

Another unwanted aspect of collecting feedback during a learning experience is the distraction caused by the process. Cognitive stress is added to the students, as well as the lecturer having to reflect on comments that may not be relevant to the subject per se and the factor of time and sequence is always in play.

For these reasons, assessment tools such as questionnaires are often implemented to create an informed overview of the challenges of the learning situation. This feedback may be of considerable value and relevance, yet it does not always contribute in time.

IV.   A KAIROS APPROACH

Consistent with the implementation of rhetorical theory in the description of the learning situation some important issues are discussed here on the basis of rhetoric, in casu *kairos*. The concept of *kairos* designates three aspects of reaching an opportune situation for a specific task. The *kairos* triad consists of opportune time, the opportune location, and the opportune manner, as shown in figure 2:
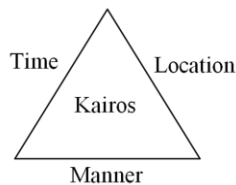
Figure 2.   Kairos triad

Implementing the *kairos* model on the discussion on feedback adds methodological overview. A sustainable use of gathering and processing of feedback should be consistent with all three parameters present in this model.

In a persuasive technology discourse, B.J. Fogg argues that "the dynamics underlying suggestion technology date back to a principle of persuasion called Kairos. Discussed by ancient Greek rhetoricians, kairos means finding the opportune moment to present your message." [9]. In the use of a persuasive application for assessment, the implementation of rhetorical theory is thus not unheard of.

A. *The opportune time:*

- Feedback should be collected and assessment made at a moment where this does not conflict or interfere with the primary teaching task.
- Furthermore, the collected data and the new insights should be available for the teacher at the opportune moment in the learning experience.
- The collection and processing should be completed in realtime.

B. *The opportune location:*

- Feedback should be collected and processed in a way that does not require a physical absence from the original learning situation.
- Collecting feedback onsite should not disturb the overall concentration of the learning experience by disturbing the relevant learning scenarios.

C. *The opportune manner:*

Feedback should be collected and processed in such a way that:
- It is easily collected without increasing the cognitive load of the informer.
- It is easily handled and processed by the teacher.
- It allows a variety of expressions.
- It does not limit too strictly the freedom of the user to express opinions and interests not foreseen by the teacher.
- It supports anonymity as well as personal or group identification where this is relevant.
- It presents a relevant balance between detail and overview.

- It allows for storing, sharing and cross tabulation, where applicable.

Making this *kairos* analysis the foundation for the development process supports the formulation of relevant criteria for a sustainable system for the collection of feedback.

V.   CONTINOUS FEEDBACK

In coherence with the analysis above and the parameters important for the collection of feedback and the facilitation of suitable assessment, it is clear that the temporal factor is of definite importance. Approaching a pedagogical implementation of interactivity may be possible only in a realtime or near-realtime context.

This may imply that the collection of feedback should not be understood as an isolated item in a sequential learning experience but rather as a underlying process, supporting the basic learning strategy. Thus, a system facilitating continuous feedback should be implemented.

In the light of experiences with technology enhanced learning and TEL-systems (Technology Enhanced Learning), it appears evident that such a continuous feedback support system should be provided through implementing a suitable assessment system capable of meetings the general demands of the *kairos* analysis.
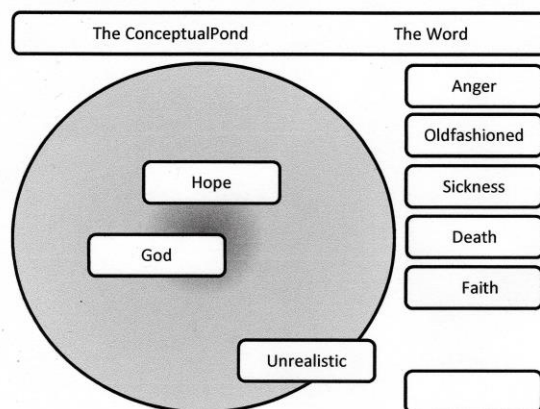

Figure 3.   The Conceptual Pond – reduced in complexity

In the case studies of this paper, an intuitive interface for assessment and collection of data The Conceptual Pond application has been used. The Conceptual Pond [10] [11] is a visual interface facilitating easy and intuitive collection of qualitative data. The user interface is quite simple and allows the user to select one or several words or phrases that resemble the intended expression of the user. If no suggested text is fitting, the users may add their own text. A purely visual representation through images is also supported. After selecting the relevant text, the user applies this text to a circle marking the distance from the center which corresponds to which the user finds this textual expression important.

By doing so, the user easily supplies feedback, even on quite complex questions, as exemplified in Case Study 1. Once the qualitative data are collected through using the system, the collected data are instantly quantified into graphs creating an instant overview for the teacher. Using this system supports the desire for continuous feedback, as the user can always move or substitute the text with something else. Such changes are immediately reflected in the graphs available for the teacher in realtime.

Though the overall argument of this paper is not tied to the implementation of any one system for interactive assessment (such as The Conceptual Pond), the facilities of the system is important as the system should satisfy all or most of the criteria listed in relation to the *kairos* analysis. Obviously, ease of use, user freedom, and instant teacher overview are important factors.

Referring to the principles of the hermeneutic circle of Gadamer [12], it is obvious that the continuous feedback approach, in reality resembles the process of recognition as devised in this model. Issues important to the user in the beginning of the learning experience may lose importance or be transformed into new questions or issues of relevance. Through a continuous feedback approach both learner and teacher should benefit from the pedagogical potential of this.

VI. USE CASES

Two tests using The Conceptual Pond for advanced feedback are presented in this paper. In both cases, the focus has been on teenagers, but they are not part of the same group. They have not been chosen for the tests through any special selection process.

A. Reflections on the movie The Word

A group of 23 Danish teenagers from confirmation class (13-14 years old) viewed a selected scene from the play "The Word" by Danish playwright Kaj Munk (1962) in a well-known 1955 movie adaptation of Carl Th. Dreyer. The test took place in 2012.

Despite an antiquated visual language with remarkably slow dialogue and black/white aesthetics, the scene of the resurrection of a woman deceased in childbirth appeared quite moving for the teenagers.

Immediately after the screening of the film and before proceeding with the scheduled program, all teenagers entered their immediate impression and thoughts to the assessment interface. In this way, feedback was secured in a very short time and answers were stored as well as quantified and available instantly for the teacher as a graph.
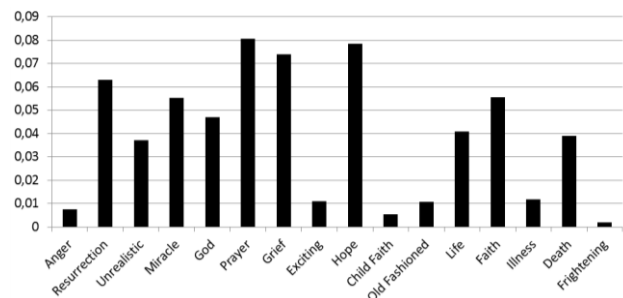

Figure 4. Graphic presentation

Completing the quite complex feedback process on computers was performed in an average of 105 seconds (variation 75 – 135 seconds). In a subsequent testing under similar conditions and a similar use case (2014) feedback was even more rapid using a touch device (iPad) reducing average feedback time to 95 seconds (variation 60 – 110 seconds). This observation suggests that the more tangible handling offers enhanced intuitiveness in interaction with the application and therefore greater speed.

The graph (figure 4) was available for the teacher immediately after the gathering of information, thus empowering him immediately to focus the teaching program in the direction of issues important to the learners.

From a pedagogical perspective, the feedback was rich for several reasons:

- All teenagers made a relevant contribution and they were heard equally. In ordinary teaching conditions in class, it would only be possible to hear the impressions of a selected number of students. Now, everyone did participate in a synchronous sharing of thoughts.
- Some of the results were surprising and provided a good foundation for designing the further teaching process. For example, the teenagers did not mind much that the movie was "old-fashioned" and the vivid scenes of a woman rising from the dead did not frighten them. "Prayer" and "hope" have scores twice as high as the quite relevant "unrealistic", suggesting that the students did internalize the intended message of the author rather than reacting to the surface level of the play.
- The teenagers were able to compare their own reflections with the reflections of peers, which is an important persuasive factor, as suggested by Oinas-Kukkonen and Harjumaa [13].

In a subsequent inquiry, all teenagers preferred The Conceptual Pond to traditional aids for assessment such as questionnaires and multiple choice tests. Such assessment tools are regularly used in school, so the teenagers have a considerable familiarity using them.

At the same time, a group discussion was implemented in order to verify that the expressions codified in the data-set

were representative of the expressions uttered in a group discussion. This was the case.

B. Feedback at teaching on robots and ethics

A group of 24 Danish teenagers from the municipal school of Nørager (13-14 years old) were taught on the subject of robots and ethics. The test took place in 2013.

The Conceptual Pond was used twice during the actual teaching process, making the teenagers multitask in order to listen, reflect, and answer synchronously. For this reason, the time used for filling in the pond is not specified. It was done synchronously with teaching.

The first question asked the students which one of the presented subjects was the most interesting to them. Not surprisingly, "dangerous robots" as well as "cyborgs" were the most interesting and "ethics" scored quite low. "Talking with a robot" was also quite low. In the course of teaching, the students were encouraged to interact with a chat-robot providing them with an initial experience of communicating meaningfully with an Artificial Intelligence-system [14]. After this unexpected experience, the subject "talking to a robot" advanced to being the second most interesting subject, almost tripling in popularity.

From a pedagogical perspective the feedback was rich for several reasons:

- The feedback allowed the teacher to focus on subjects relevant to the learner. Obviously, "dangerous robots" could not be the full content of the learning experience. But the sequence in which subjects were presented was influenced and "dangerous robots" often used as examples.
- Through the continuous feedback, the teacher was able to detect the growing fascination by "talk to a robot" end elaborate on this in the learning experience. If the initial expressions of interest had not been adjusted through continuous feedback, the teacher might have focused too narrowly on "dangerous robots" reducing the potential of teaching to fit the changing interests of the students.

Later in the same teaching session, the teenagers were challenged to sort different robots in the order in which they found them the scariest. The objective was to confirm or falsify the assumption that the Uncanny Valley observation of Masahiro Mori [15] also applies to Danish teenagers.

After filling out The Conceptual Pond the teenagers watched a video presenting the Uncanny Valley. Much to their surprise, the graph presenting their answers in detail did correspond exactly with the uncanny Valley argument.

From a pedagogical perspective, the feedback was rich as it revealed not only knowledge, but also interest and immersion and facilitated an enhanced level of reflection not typical of students at this level of education:

- The teenagers instantly understood themselves as part of a scientific experiment. In this way they came to value scientific tradition, suddenly realizing research was relevant.
- In contrast to a traditional test on paper that would require manual processing, the result was immediately available and presented visually on a big screen. The three aspects of *kairos* are thus implemented.
- The emotional impact of peer comparison in relation to the reception of robots may be expected to support the reflection on the themes presented in the teaching. The students were genuinely surprised realizing that they did indeed mirror the Uncanny Valley theory of Mori.

From these two quite different use cases, it may be derived with a substantial degree of credibility that continuous feedback is a strong persuasive factor and it does add extra possibilities, and, therefore, extra quality to traditional teaching.

No difficulties were detected through the tests except for the fact, that links to the online environment of The Conceptual Pond should be distributed in advance. Since students in Danish schools use a variety of devices from smartphones to iPad's, to laptops, it is essential that the feedback system supports all platforms. This is one of the advantages of The Conceptual Pond in comparison to a number of TEL applications designed with a limitation to a specific platform.

VII. Consequences for Teaching

Implementing feedback in a rather radical way, as it is suggested and exemplified above, does pose some challenges to traditional teaching. The content of teaching may mostly remain the same, but the sequence and context in which it is shared may be required to change. The *kairos* approach influences education in double movement:

Continuous learning feedback, on one side, allows the educator to be informed about the position, knowledge, or attitude of the learner. On the other hand, it simultaneously offers the teacher the opportunity of sharing this information with the learner in a real-time environment.

Referring again to classical rhetoric the five *canons* for preparing a piece of communication, this model may act as a framework or example. The five canons consist of *inventio* (developing and refining arguments and other content), *dispositio* (arranging and organizing content), *elocutio* (stylistic choices and eloquence), *memoria* (memorizing), and *actio* (delivery). From a traditional point of view, this process is sequential. The preparation takes place in steps in the right order. Implementing continuous feedback and taking advantage of the possibilities may require a more liquid approach to the rhetorical situation (in casu teaching). The sequence prepared in *dispositio* may be challenged

which may require the educator to focus more directly on *inventio* and *eloqutio* recognizing that the teaching prepared may in fact have to be changed at some level adjusting to the enhanced level of knowledge of the learners facilitated by structured feedback.

VIII. CONCLUSION AND FUTURE RESEARCH

In terms of theory, there is a substantial leap from classical rhetoric to the implementation of a continuous feedback system through a digital application, as is analysed and suggested in this paper. Nevertheless, this leap is important as the implementation of continuous learning feedback appears to be promising in developing novel concepts for learning.

Though traditional methods for assessment and acquiring feedback such as written tests, oral consultation, questionnaires, and multiple choice tests may be helpful in a number of contexts, it is clear that at least two challenges remain. One challenge is the element of *kairos*: Acquiring the right knowledge at the right time – and even sharing it with the learner simultaneously. Another challenge is the observation that feedback may be more comprehensive than traditional assessment. An example could be the suggestions made [16], that in the field of e.g. cultural mediation the predominantly simplified nature of traditional assessment is inadequate for monitoring the complex experiences and reflections done by the learner.

Much research is left to be done in the field of using feedback in a digital system. The aspect of ownership to the educational process if the user is engaged more in reflecting and commenting openly should be explored deeply. The use of a familiar electronic device such as your own smartphone instead of potentially alienating white paper may also be of importance.

In this paper, some of the possible uses of such system have been described. There are many other use cases to explore and recognitions to be made from these, again adding to agile development process of continuous learning feedback.

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