Electronic Profiling Portal for Curriculum Management and Evaluation

BACKGROUND

Technical Field

Embodiments of the invention relate to methods and systems for data storage, data collection and data reporting.

Description of Related Art

Data collection and reporting are vital to many organizations where large amounts of data are collected and compiled into reports to facilitate performance evaluation.

In many educational institutions, for example, performance reports of students currently adopt one of the followings formats:

(1) Descriptive Report: A description of a student's progress relating to various aspects, such as physical, social, emotional and cognitive development.

(2) Report Card: A listing of learning objectives with brief description of attainment levels.

(3) Portfolio Report: Collection of anecdotal evidence of a student's learning activities.

Each of the above reporting formats has its inherent limitations. For example, a descriptive report requires an assessor to possess good writing and analytical skills, and is unable to provide comparative benchmarking or anecdotal evidence. A report card provides limited information on areas of improvements or concerns, and is unable to provide anecdotal evidence. A portfolio report provides limited areas of feedback, is time-consuming to implement, and is unable to provide comparative benchmarking.

Each reporting format already requires a significant expenditure of human resource in its administration. To provide a comprehensive evaluation and performance report incorporating all the reporting formats above would be extremely tedious and beyond the capability of many educational institutions.

SUMMARY OF EMBODIMENTS OF THE INVENTION

Embodiments of the invention provide a method and system for data collecting and reporting. The method includes uploading into a database acquired scores attained by a cohort of subjects corresponding to a predefined criterion and generating reports on one or more of the subjects. Upon generating a report on one of the subjects, a statistical distribution based on the acquired scores of the subjects is computed for each predefined criterion, and a visual representation is provided in the report to illustrate certain predefined characteristics of the corresponding statistical distribution. The visual representation may be disposed in juxtaposition with the acquired score of the subject to indicate a relative standing of the subject within the cohort for each criterion.

In addition, the method may also include uploading into a database portfolio data completed by the subjects corresponding to each predefined criterion. The portfolio data may be linked or tagged to the criterion. Further, an indicium may be provided in the report to provide access to the portfolio data for the particular criterion.

Embodiments of the invention are particularly advantageous in collecting and processing data to provide a report that includes a score component, an anecdotal component and a comparative component. This way, recipients of the report are provided with all three components presented in a single reporting format for ease of access.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1A illustrates an excerpt of a sample performance report.

FIG. 1B illustrates a continuation of the excerpt of FIG. 1A.

FIG. 2 illustrates a system block diagram of one embodiment of the invention.

FIG. 3 is a sample screen shot containing predefined criteria and associated suggested tasks.

FIG. 4 is a flow sequence of a data collection and reporting method according to one embodiment of the invention.

FIG. 5 is a sample screen shot for uploading acquired scores of a subject for various predefined criteria into a database.

FIG. 6 is a sample screen shot for uploading portfolio data into a database for a predefined criterion.

FIG. 7 illustrates the structure of learning criteria database and relationships between key components of the database.

FIGs. 8A and 8B illustrate a scheme of classifying various aspects of learning objectives or criteria in a database.

FIGs. 9A and 9B illustrate examples of box-plots.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

In the following description, numerous specific details are set forth in order to provide a thorough understanding of various illustrative embodiments of the present invention. It will be understood, however, to one skilled in the art, that embodiments of the present invention may be practiced without some or all of these specific details. In other instances, well known process operations have not been described in detail in order not to unnecessarily obscure pertinent aspects of embodiments being described. In the drawings, like reference numerals refer to same or similar functionalities or features throughout the several views.

Embodiments of the invention collect performance data in various formats, e.g. criterion-based evaluation (or rubrics assessment), portfolio assessment and norm-referenced evaluation (or comparative benchmarking), and process the data in the various formats to provide a performance report on an individual (or a subject) for access from a single interface in an electronic portal. Embodiments of the invention may be used for performance assessment in various settings, including but not limited to, educational institutions and corporations. Examples in the present disclosure relate to an application in an education institution. However, it should be appreciated that the invention may be applied in other settings with suitable modifications.

A sample excerpt of a performance report 100 provided by the portal is illustrated in FIGs. 1A and 1B. The performance report 100 may set forth various general development areas, e.g. social, emotional, moral, as well as language development areas, e.g. communication, phonics, reading and writing. For each development area, one or more learning objectives and/or sub-areas (hereinafter referred to as criteria) may be defined. For example, the "social" aspect may include three criteria, e.g. interaction with peers, interaction with adults, and cooperation & orderliness and the corresponding achievement or score descriptor indicated as shown in FIGs. 1A and 1B. However, it should be appreciated that any other number of achievement levels or scores may be specified.

Embodiments of the invention provide performance feedback using three assessment components: an achievement level or score component, an anecdotal component and a comparative component (corresponding to criterion-based evaluation, portfolio assessment and norm-referenced evaluation respectively).

For the anecdotal component, anecdotal evidence (hereinafter referred to as portfolio data) may be tagged or associated with a corresponding criterion. Examples of portfolio data include, but are not limited to, photographs, video

clips and images of completed tasks or assignments. The portfolio data 102 may be made available for access in the form of an image file, a video file and an audio or music file. In FIGs. 1A and 1B, an indicium, e.g. thumbnail, is provided which may be activated to access a larger image of a portfolio data. The indicium may include a Uniform Resource Locator (URL) which may be activated or used to provide access to a portfolio data 102 file accessible on the Internet. Alternatively, the portfolio data 102 may be directly accessed by providing the image in an appropriate size for viewing.

For the achievement level or score component, an acquired score 104 may be displayed, e.g. by checking a box of a corresponding achievement score or description, or highlighting the score or description, or in any other similar manner. Alongside the acquired score 104, a comparative component is disposed in proximity or juxtaposed to illustrate the relative standing of the subject's (or student's) achievement among a predetermined cohort of subjects.

The comparative component is linked to a predetermined criterion as it is based on a statistical distribution of all the acquired scores of a cohort of subjects for that criterion. The comparative component may be provided as a visual representation illustrating predefined characteristics of the statistical distribution which are of interest in assessing a student's relative standing in the cohort. Examples of predefined characteristics include, but are not limited to, lowest score, highest score, median score, average score (or mean) and one or more N^{th} percentiles. In addition, the total number of students in the cohort may also be provided. An example of a visual representation is a box plot 106 (or a box-and-whisker diagram), but is not limited as such.

The box plot 106 (see FIGs. 1A, 1B, 9A and 9B) comprises a box feature flanked by or interposed between whiskers, if any. Whisker ends which are remote from the box feature indicate the lowest or highest acquired score

achieved by a cohort of subjects. Whisker ends which are proximate to the box indicate predetermined percentiles, such as, but not limited to, 10^{th} and 90^{th} percentiles. Whiskers may not be present in certain box-plots if the range of acquired scores is narrow. A centre indicator or line may be included in the box feature to indicate the average acquired score of the cohort. The box feature may contain shadings to aid users visualize score density. For example, a darker shade in a region surrounding the average acquired score indicates that most acquired scores are clustered around the average score.

Several equations for determining a box plot having a 10^{th} and 90^{th} percentile indicators are set forth:

n = number of achievement levels

X = Individual Achievement Score Assigned $\{X: X = 1, 2, 3, \ldots, n\}$

N = number of children used in computation

Lowest Score: X_{min} = Minimum (X) $\{X_{min}: X = 1, 2, 3, \ldots, n\}$

Highest Score: X_{max} = Maximum (X) $\{X_{max}: X = 1, 2, 3, \ldots, n\}$

Average Score: $$\mu = \frac{\sum X}{N}$$

Sum of Squared Deviations: $$SS = \sum X^2 - \frac{\left(\sum X\right)^2}{N}$$

Standard Deviation: $$\sigma = \sqrt{\frac{SS}{N}}$$

10th Percentile: $X_{10} = \mu - 1.28\sigma$

90th Percentile: $X_{90} = \mu + 1.28\sigma$

An illustrative example involving five statistical characteristics (lowest acquired score, highest acquired score, average acquired score, 10th percentile and 90th percentile) for a cohort of ten students is set forth below.

Example:

For a set of 10 scores {1, 1, 2, 2, 2, 3, 3, 3, 4, 4}

Lowest Score: $X_{min} = 1$

Highest Score: $X_{max} = 4$

Average Score: $\mu = \frac{1+1+2+2+2+3+3+3+4+4}{10} = 2.5$

Sum of Squared Deviations:

$$SS = (1^2+1^2+2^2+2^2+2^2+3^2+3^2+3^2+4^2+4^2) - \frac{(1+1+2+2+2+3+3+3+4+4)^2}{10}$$

$$= 73 - \frac{625}{10} = 10.5$$

Standard Deviation: $\sigma = \sqrt{\frac{10.5}{10}} = 1.024$

10th Percentile: $X_{10} = 2.5 - 1.28 \times 1.024 = 1.188$

90th Percentile: $X_{90} = 2.5 + 1.28 \times 1.024 = 3.812$

Using the above calculation results, a box-plot as shown in FIG. 9B may be drawn. While FIG. 9B shows certain values of the statistical distribution, this may not be required in other embodiments of the invention.

Reference is now made to FIG. 2 illustrating a system block diagram of an embodiment of the invention. The system comprises one or more databases 202 and a server engine or processor 204 having access to the databases 202. An application program 206 provides an interface for user access to the databases 202 through the server engine 204 from client machines 208a-208b. The application program 206 may be installed in the client machines 208a-208b. Alternatively, the application program 206 may be a web application program installed at the server and made accessible to the client machines 208a-208b through the Internet or a local area network. The database 202 contains a plurality of records 210 corresponding to a plurality of subjects, where each record comprises various criteria as well as acquired scores and portfolio data corresponding to each criterion. Users, including end-users (e.g. parents or students), assessors (e.g. teachers), and system administrators, may access subject records and curriculum management information from client machines 208a-208b. Client machines 208a-208b may be connected to the server engine or processor 204 via the Internet or a local area network.

A general process of managing the electronic portal is described as follows. For each criterion, various possible achievement scores and their corresponding achievement descriptions are defined and uploaded to a database. Suggested tasks for fulfilling each predefined criterion may be uploaded to the database for retrieval as and when required. FIG. 3 shows a sample screen shot where predefined criteria (302a-302d) are set out, and suggested tasks (304a-304d) for fulfilling the predefined criteria are made available for download.

A flow sequence 400 for a data collection and reporting method according to one embodiment of the invention is described with reference to FIG. 4. The flow sequence 400 begins with uploading into a database acquired scores corresponding to a predefined criterion for a cohort of subjects (block 402). FIG. 5 shows a sample screen shot for this purpose, where a record is created for each subject for uploading acquired scores corresponding to the various predefined criteria. An assessor may select or check an appropriate box indicating an acquired score attained by the subject for each criterion. The assessor may also upload any general feedback on the subject relating to the criterion. If available, the assessor may upload portfolio data detailing completed tasks corresponding to the criterion (block 404). FIG. 6 shows a sample screen for this purpose where the image files (602a-602g) of completed tasks by various subjects corresponding to a criterion 302d may be selected for uploading to the database. The uploaded portfolio data is linked to or associated with the predefined criterion so that the uploaded portfolio data may be accessed by providing an indicium proximate to the corresponding criterion in the performance report 100.

When all the acquired scores and portfolio data of a cohort of subjects are uploaded into the database, a performance report 100 for one or more subjects in the cohort may be generated (block 406). An excerpt of a sample performance report 100 is illustrated in FIGs. 1A and 1B as described earlier. Upon submitting a request to generate a performance report 100, the server engine or processor 204 generates a comparative component for each criterion (block 408). More particularly, the processor computes a statistical distribution based on the acquired scores of the subjects as stored in the database. Using the computed statistical distribution, a visual representation 106 of the statistical distribution, detailing various predefined characteristics (e.g. 10^{th} percentile, 90^{th} percentile, average acquired score) of the statistical distribution, may be provided and displayed together with the acquired score, score description (if required) and portfolio data (if available) in the report (block 410). More particularly,

the comparative component is disposed in juxtaposition with the acquired score to indicate a relative standing of the subject within a cohort for a particular criterion. The anecdotal component (portfolio data) may also be provided or displayed as an indicium in the performance report and linked to each criterion so that the indicium may be selected or clicked on to access, e.g. view, print, the portfolio data.

When changes to the records of the cohort of subjects are made, e.g. acquired score amendments and changes in the number of subjects, the changes on the comparative component may be reflected when a report on any of the subjects is next generated. Upon each instance of generating a performance report on a subject, the statistical distribution may be recomputed to incorporate any recent changes.

FIG. 7 illustrates a database structure according to an embodiment of the invention. For each learning objective or criterion, various aspects to fulfill the learning objective are predefined and uploaded into the database using the predefined database structure of FIG. 7. For each learning objective or criterion, a summary of the learning objectives, suggested task, task caption, teaching guide and a set of rubrics may be specified in one embodiment of the invention. In other embodiments, any combination of these aspects together with any other aspects may be specified. When an assessor uploads inputs, e.g. portfolio artifacts (portfolio data) and rubric assessment data (acquired scores) into the database, the inputs are linked to a predetermined learning objective or criterion. Alternatively, each learning objective or criterion may have more than one set of associated rubrics. In another alternative, each set of rubrics may be associated to more than one learning objective or criterion.

To illustrate the data structure of FIG. 7, one example of a learning objective or criterion and its associated aspects is set out below:

Learning objective or criterion	Learn Letter Shape: Aa Annie Apple and her Applestand; Mr A, the Apron Man
Summary of learning objectives	Learn Letter Shape (Lower & Upper Case): c, a, d, h, m, t, s
Suggested task	A-Z Copymasters: Upper & Lower Case
Task caption	Learn Letter Shape: Aa Annie Apple and her Applestand; Mr A, the Apron Man
Teaching Guide	Letterland Teacher's Guide
Rubrics (Possible achievement scores)	Level 1 Rubric: shows resistance in writing activities Level 2 Rubric: shows interest in writing but writes illegibly Level 3 Rubric: writes reasonably well Level 4 Rubric: writes with good handwriting
Assessment Inputs: Portfolio Artifacts or Data	Input image of any 1 Letter Shape Task for this Term
Rubric Assessment	Input acquired score of student

FIGs. 8A and 8B illustrate a scheme of classifying various aspects of learning objectives or criteria in a database. In this scheme of work, each subject is linked to one or more learning objective or criterion via additional classifications therebetween. Each of these additional classifications may differ among the subjects.

Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the present invention. Furthermore, certain terminology has been used for the purposes of descriptive clarity, and not to limit the invention. The embodiments and features described above should be considered exemplary, with the invention being defined by the appended claims.

What is claimed is:

1. A method, comprising:

uploading a plurality of acquired scores attained by a plurality of subjects corresponding to a criterion;

generating a report on one of the subjects;

computing a statistical distribution based on the acquired scores of the subjects; and

providing a visual representation in the report to illustrate a plurality of characteristics of the statistical distribution, wherein the visual representation is disposed in juxtaposition with the acquired score of the one of the subjects to indicate a relative standing of the one of the subjects.

2. The method according to claim 1, further comprising:

uploading a portfolio data completed by each of the subjects corresponding to the criterion; and

providing in the report an indicium linked to the criterion to provide access to the portfolio data.

3. The method according to claim 2, wherein the portfolio data includes one of an image file, a video file, and an audio file.

4. The method according to claim 2, wherein the indicium includes a Uniform Resource Locator.

5. The method according to claim 1, wherein the characteristics include a median, a lowest and a highest of the acquired scores.

6. The method according to claim 5, wherein the characteristics include a 10^{th} percentile and a 90^{th} percentile of the acquired scores.

7. The method according to claim 1, wherein the visual representation is a box-plot.

8. The method according to claim 1, wherein computing the statistical distribution is performed upon each instance of generating a report.

9. The method according to claim 8, further comprising providing in the report a plurality of possible achievement scores corresponding to the criterion and identifying one of the possible achievement scores as the acquired score.

10. The method according to claim 9, further comprising providing in the report a description of the acquired score.

11. A system comprising:

a database for storing a plurality of records for a plurality of subjects, the records having a plurality of acquired scores corresponding to a plurality of criteria;

a processor for generating a statistical distribution from the acquired scores for each of the criteria; and

an application program for providing a visual representation to illustrate a plurality of characteristics of the statistical distribution, wherein the visual representation is disposed in juxtaposition with one of the acquired scores of one of the subjects to indicate a relative standing of the one of the subjects.

12. The system according to claim 11, wherein the database is for storing a plurality of portfolio data completed by the subjects corresponding to the criteria.

13. The system according to claim 11, wherein the portfolio data include one of an image file, a video file and an audio file.

14. The system according to claim 11, wherein the characteristics of the statistical distribution include a median, a lowest and a highest of the acquired scores for one of the criteria.

15. The system according to claim 14, wherein the characteristics of the statistical distribution includes a 10^{th} percentile and a 90^{th} percentile of the acquired scores for the one of the criteria.

16. The system according to claim 11, wherein the visual representation is a box-plot.

17. The system according to claim 12, wherein the database is for storing a plurality of tasks corresponding to the criteria.

18. The system according to claim 11, wherein the application program is a web application program.

19. A method of data reporting, comprising:

providing an application program configured to generate a report for a subject, the report including a score component, an anecdotal component and a comparative component corresponding to a criterion, wherein the comparative component is disposed in juxtaposition with the score component to indicate a relative standing of the subject within a cohort of subjects, the comparative component being a statistical distribution computed from a plurality of score components of the cohort of subjects, and wherein the anecdotal component is provided as an indicium linked to the criterion which can be selected to access the anecdotal component.

20. The method of claim 19, wherein the application program is configured to compute the statistical distribution upon each instance of generating a report.

21. The method of claim 19, wherein the application program is a web application program.