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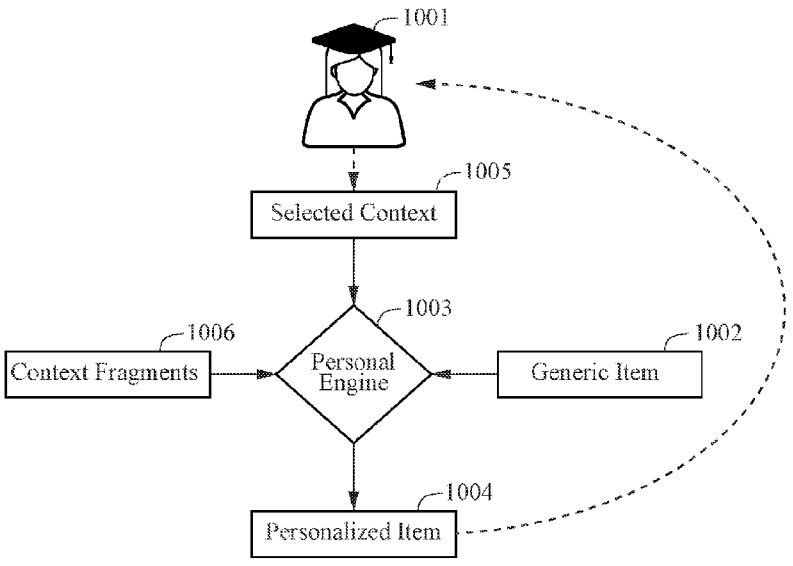

FIG. 1

(57) Abstract: A computer-implemented method for generating a personalized educational item is disclosed herein. A personalization engine personalizes instruction and assessment for a student based on a context selection related to student interests, preferences, needs, answers, data, social network, and similar personal information. Associated with the context are context fragments, which may be text, fragments associated with the selected context, thereby generating the personalized education item.

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Title

Methods For Parallel And Personalized Education

Technical Field

[0001] The present invention generally relates to educational instruction and assessment.

Background Art

[0002] Modern education is evolving from a cohort paradigm to a personal paradigm. Traditionally, students were grouped by age and location into a class and each class was given a uniform curriculum. This cohort method was largely a product of contemporary technologies and resource limitations. While resource efficient, cohort education targets the needs of the average student and to some degree neglects the needs of both the advanced and trailing students.

[0003] With advances in computing and telecommunications, personalized education is now practical. The present invention describes novel methods by which educational instruction and assessment can be efficiently and effectively personalized for students, allowing them to learn at their uniquely optimal pace, at their appropriate level, using contexts they specifically find engaging.

Summary Of The Invention

[0004] The present invention is termed Parallel and Personalized (PaPer) education.

[0005] A first aspect of the present invention is a method to personalize instruction and assessment for a student based on student interests, preferences, needs, answers, data, social network, and similar personal information.

[0006] A second aspect of the present invention is adapting instruction and assessment items for students with learning disabilities and/or special needs.

[0007] A third aspect of the present invention is individualizing assessment questions for improved validity and quality according to Item Response Theory (IRT), Classical Test Theory (CTT), and similar psychometric models.

[0008] A fourth aspect of the present invention is a print-to-digital cycle wherein a computer program recommends an educational print item (e.g. worksheet) according to a student's computer-interfaced assessment. Optionally the educational print item is printed locally by the teacher or student; or alternatively the educational print item is printed by a service that physically mails the item to the teacher or student.

[0009] A fifth aspect of the present invention is a computer program enabling a teacher to print personalized worksheets for a student.

[00010] A sixth aspect of the present invention is assessment data recorded on the blockchain.

[00011] A seventh aspect of the present invention is an assessment-item recommendation cycle in a computer application, wherein a student completes an educational item, then takes an assessment, and is presented with a next educational item according to the assessment score.

[00012] Another aspect of the present invention is a computer-implemented method for generating a personalized educational item. The method includes receiving a context selection from a plurality of possible context selections. The method also includes accessing a media item associated with the context selection. The method also includes accessing an educational item. The method also includes combining the media item and the educational item to form a personalized educational item. The method also includes presenting the personalized educational item to the user.

[00013] Yet another aspect of the present invention is a computer-implemented method for generating a personalized educational item. The method includes receiving a plurality of social network connections for a user, each connection comprising at least a name. The method also includes accessing an educational item. The method also includes combining the educational item and at least

one name of one social network connection of the plurality of social network connections to form a personalized educational item. The method also includes presenting the personalized educational item to the user.

[00014] Yet another aspect of the present invention is a computer-implemented method for generating a combined educational item. The method includes assessing a user on a first subject. The method also includes assessing a user on a second subject. The method also includes selecting a first educational item related to the first subject according to the results of assessing the user on the first subject. The method also includes selecting a second educational item related to the second subject according to the results of assessing the user on the second subject. The method also includes combining the first educational item and the second educational item into a combined educational item. The method also includes presenting the combined educational item to the user.

[00015] Yet another aspect of the present invention is a computer-implemented method for generating a combined educational item. The method includes assessing a user on a first subject. The method also includes assessing a user on a second subject. The method also includes selecting a first educational item related to the first subject according to the results of assessing the user on the first subject. The method also includes selecting a second educational item related to the second subject according to the results of assessing the user on the second subject. The method also includes combining the first educational item and the second educational item into a combined educational item. The method also includes presenting the combined educational item to the user.

[00016] Yet another aspect of the present invention is a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a personalized educational item by: receiving a plurality of social network connections for a user, each connection comprising at least a name; accessing an educational item; combining the educational item and at least one name of one social network connection of the plurality of

social network connections to form a personalized educational item; and presenting the personalized educational item to the user.

[00017] Yet another aspect of the present invention is a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a combined educational item by: assessing a user on a first subject; assessing a user on a second subject; selecting a first educational item related to the first subject according to the results of assessing the user on the first subject; selecting a second educational item related to the second subject according to the results of assessing the user on the second subject; combining the first educational item and the second educational item into a combined educational item; and presenting the combined educational item to the user.

Brief Description Of the Drawings

[00018] FIG. 1 illustrates one embodiment wherein a personalization engine personalizes an educational item according to the student's selected context preference.

[00019] FIG. 1A illustrates one example of FIG. 1 using a baseball context for a math assessment item.

[00020] FIG. 2 illustrates one embodiment wherein the personalization engine personalizes an educational item according to the student's previous answers.

[00021] FIG. 3 illustrates one embodiment wherein the personalization engine personalizes an educational item according to the student's data, for example, demographic data.

[00022] FIG. 4 illustrates one embodiment wherein the personalization engine personalizes an educational item according to the student's social network data.

[00023] FIG. 5 illustrates one embodiment wherein the personalization engine personalizes an instruction recommendation according to the student's social network data.

[00024] FIG. 6 illustrates one embodiment wherein the personalization engine personalizes an assessment question format according to the student's disability data.

[00025] FIG. 7 illustrates one embodiment wherein structured data is converted into narrative text.

[00026] FIG. 8 illustrates one embodiment of a gradebook-style report of normalized answers to one question on an assessment.

[00027] FIG. 9 illustrates one embodiment wherein an assessment question is personalized for each of a group of students, then results are normalized in a report.

[00028] FIG. 10 illustrates a cycle of assessment to educational item.

[00029] FIG. 11 illustrates a student assessment recorded on a blockchain.

[00030] FIG. 12 illustrates an instruction-assessment cycle in an education application.

[00031] FIG. 13 illustrates a computer program personalizing an educational print item for a student.

[00032] FIG. 14 illustrates an assessment-recommendation-personalization cycle.

[00033] FIG. 15 illustrates a multisubject assessment-recommendation-combination cycle.

Best Mode(s) For Carrying Out The Invention

[00034] FIG. 1 illustrates one embodiment wherein a student **1001** selects a context **1005**. The personalization engine **1003** uses this selection to combine a generic educational item **1002** with context fragments **1006** to form a personalized educational item **1004** that is then presented to the student **1001**.

[00035] The selected context **1005** is typically a topic the student has an affinity toward, such as baseball or space exploration. In one embodiment, the student selects a context **1005** using a software application on a computing device such as a desktop, laptop, tablet, or mobile phone. In an alternate embodiment, the student communicates a context selection **1005** to a teacher, orally or in writing, who then enters that context into a computing device.

[00036] The generic education item **1002** is optionally an electronic assessment question, an electronic lesson (optionally comprising text, audio, video, or interactive media), a print assessment question, a print worksheet, or other print item. The generic education item **1002** comprises acontextual fragments which the personalization engine **1003** replaces with context fragments **1006** according to the selected context **1005**. Contextual fragments are optionally in the medium of text, image, audio, video, games, virtual reality objects, or other media.

[00037] The present invention preferably comprises a database of context fragments **1006**, each associated with one or more selectable contexts **1005** and a medium such as text, image, audio, virtual reality, augmented reality, or video.

[00038] In one embodiment, the generic educational item **1002** is a text assessment question. The personalization engine **1003** replaces acontextual phrases with context fragments **1006** embodied as text phrases related to the selected context **1005**. For example, a text generic education **1002** item may contain the acontextual fragment *OBJECTS* which the personalization engine **1003** replaces with the context fragment **1006** *baseballs*.

[00039] In another embodiment, the generic educational item **1002** is a lesson in a multimedia application such as a website or a tablet application. The personalization engine **1003** replaces acontextual image placeholders with context fragments **1006** embodied as images related to the selected context **1005**. For example, a text generic education **1002** item may contain an acontextual fragment indicating a 200x200 pixel image which the

personalization engine **1003** replaces with the context fragment **1006** of an image of a baseball. In one embodiment, the personalization engine alters the `SRC` attribute of an `<IMG>` HTML tag or similar.

[00040] In another embodiment, the generic educational item **1002** is a lesson in a multimedia application such as a website or a tablet application. The personalization engine **1003** directs the student's user interface to download and play a context fragment **1006** embodied as a video related to the selected context **1005**. For example, the student's application downloads and plays *baseball.mp4*.

[00041] In another embodiment, the generic educational item **1002** is a print worksheet. The personalization engine **1003** replaces acontextual image placeholders with context fragments **1006** embodied as images related to the selected context **1005**. The worksheet is optionally in HTML, PDF, DOC, or similar format.

[00042] In one embodiment, the personalized educational item **1004** is presented to the student **1001** electronically in a software application such as a web browser, native computer application, tablet application, or mobile phone application; in an alternate embodiment the personalized educational item **1004** is presented to the student **1001** on a print medium such as paper. Optionally the print item is physically mailed to the student **1001.**

[00043] The personalization engine **1003** is a combination of computer hardware and software programmed to personalize student assessments and/or instructions. Optionally, the personalization engine **1003** is embodied on a network server. Optionally, the personalization engine **1003** is embodied on a cloud server such as those offered by Amazon Web Services, Google Compute Engine, or Microsoft Azure. In one embodiment, the student **1001** use a computer user interface (e.g. web browser or mobile application) that accesses the personalization engine **1003** over a network connection (e.g. the Internet)

through an Application Programming Interface (API). Optionally the personalization engine **1003** is embodied on a personal computing device such as a desktop computer or laptop computer. Optionally the personalization engine is embodied on a mobile computing device such as an Apple iPhone, Apple iPad, Microsoft Surface tablet, Android tablet, or Android phone.

[00044] In one embodiment, the student **1001** selects multiple contexts **1005**, each associated with a distinct context fragment **1006**, and each combined with the generic education item **1002**. For example, the student selects a context **1005** of baseball and a of elephants and the personalized item **1004** comprises images of elephants playing baseball.

[00045] The present invention is optionally applied to academic tests including the Scholastic Assessment Test (SAT), American College Testing (ACT), Law School Admission Test (LSAT), Graduate Record Examination (GRE), Graduate Management Admission Test (GMAT), and similar tests.

[00046] FIG. 1A illustrates one example of FIG. 1 wherein a student **1001** selects a context of *Baseball* **1005A**. The personalization engine **1003** then combines a generic text assessment question **1002A** with a context fragment **1006A** associated with the *Baseball* context to form a personalized assessment question **1004A** that is present to the student **1001**.

[00047] FIG. 2 illustrates one embodiment wherein a student's **1001** previous answers to questions **2005** are used by the personalization engine **1003** to personalize an educational item **1002.** The personalized educational item **1004** is displayed to the student. For example, the student has correctly answered previous questions about baseball more often than previous questions about football, therefore the personalization engine personalizes the next question to be about baseball.

[00048] FIG. 3 illustrates one embodiment wherein a student's **1001** data **3005** is used by the personalization engine **1003** to personalize an educational item

1002. Student data **3005** optionally includes demographic information such as age, gender, ethnicity, race, socioeconomic status, and parental status. Student data **3005** optionally includes linguistic characteristics such as native language and English Language Learner (ELL) status. Student data **3005** optionally includes diagnoses for disorders such as dyslexia, dyspraxia, dyscalculia, dysgraphia, autism, attention deficit disorder (ADD/ADHD), or other diagnosis. Optionally, student data **3005** is determined by a human. Optionally, student data **3005** is determined algorithmically, including algorithmic analysis of previous answers and application usage.

[00049] In one embodiment, the personalization engine **1003** uses student data **3005** to guess student interest and personalize a question accordingly. For example, the personalization engine knows the student is a 10-year-old male that lives in Oakland, CA, and therefore guesses the student has an interest in the Oakland Athletics baseball team, and therefore references the Oakland Athletics in an assessment question. Optionally, the data-to-interest guess is made according to statistical or machine learning analysis of other students' data-to-interest data. Optionally, student interests are associated with brands engaged in promotions and/or partnerships with the entity implementing the present invention.

[00050] In one embodiment, the personalization engine **1003** personalizes characters in educational items to match the demographic information of a student, including race and gender. In another embodiment, the student **1001** is presented with instruction/assessment items concerning an intimate partnership between two characters. The personalization engine **1003** personalizes the pronouns and partner titles of the characters according to student data **3005** such as the student's sexual orientation.

[00051] The data source for student data **3005** is optionally a learning management system (LMS) or student information system (SIS).

[00052] FIG. 4 illustrates one embodiment wherein a student's **1001** social network data **4005** is used by the personalization engine **1003** to generate a personalized item **4002** from a generic item **1002**. The student's social network data is based on connections to other students **4006**.

[00053] Optionally, social network data **4005** comprises connections within an educational software application. For example, a mobile application implementing the present invention allows students to connect to each other, wherein these connections provide the social network data **4005**. Alternatively, social network data comes from an authority grouping students, for example, a K-12 school grouping students into a class. Optionally, social networking data comes from a service primarily designed for social networking such as Facebook, Twitter, or TikTok. Typically, social network data **4005** is stored in a database on an internet server and accessed by a client application such as a tablet application.

[00054] Social network data **4005** optionally includes the names of connected persons, activities of connected persons, pictures of connected persons, text written by connected persons (e.g. blog posts), online educational activities of connected persons, and other data stored in the social network related to connected persons.

[00055] Optionally, social networked students' pictures or avatars are integrated into educational items.

[00056] FIG. 5 illustrates one embodiment wherein a personalization engine **1003** recommends a lesson based on a student's **1001** social network data **4005**. A second student **5006** is connected to the first student's **1001** social network. The second student **5006** completes an education unit titled *Butterfly Lesson* **5007**. The personalization engine **1003** determines that the first student might benefit from the lesson **5007**. In a computer user interface, the personalization engine **1003** prompts the first student **1001** with a message **5004** recommending the lesson **5007.** The message **5004** is personalized with the name of the second

student **5006**, a picture of the second student **5006**, and the name of the lesson **5007**.

[00057] Optionally, the message is conveyed by emphasizing the lesson in a list of lessons, for example, placing an icon next to the recommended lesson. Optionally, the message is framed competitively, for example, "Billy completed this lesson in three minutes, can you beat his time?"

[00058] FIG. 6 illustrates one embodiment wherein a student's **1001** data **6005** is used by the personalization engine **1003** to personalize a generic assessment question **6002** into a formatted assessment question **6004.** In one embodiment, the generic assessment question **6002** is adapted to the special needs of a student with a learning disability. The generic question **6002** is associated with a plurality of presentation formats (**6004, 6014, 6024**). Optionally, the generic question **6002** contains information that will be presented to the student. Alternatively, the generic question **6002** is an identifier associated with the formatted questions (**6004, 6014, 6024**). The first formatted question **6024** is audio. The second formatted question **6014** is written numerals. The third formatted question **6004** is visual. The personalization engine **1003** delivers the third formatted question **6004** to the student **1003**. Optionally formatted instruction is delivered. Optionally, the delivered formatted question is selected from one or more static files. Optionally, the delivered formatted question is dynamically generated.

[00059] FIG. 7 illustrates one embodiment wherein structured data **7002** is transfigured to narrative text **7014**. The personalization engine **7003** selects entities **7012** from structured data **7002**. The structured data **7002** stores data points (e.g. subjects, objects, modifiers, actions) about a narrative in non-natural-language form. The personalization engine **7003** transfigures the selected entities to natural language text **7014** according to relevant student data **3005** (e.g. previous answers or demographic data). In one embodiment, the personalization engine **7003** transfigures the entities into basic reading level

English text **7014**. In another embodiment, for a student learning a foreign language, the personalization engine **7003** transfigures the entities into foreign language text such as Spanish **7034**.

[00060] As the student's reading abilities improve over time, the personalization engine repeats the question to the student transfigured into progressively higher reading levels **7024**. This allows for analysis of one student's progress at multiple points in time, while also allowing for a comparison between multiple students at one time.

[00061] Optionally, a plurality of entities is transfigured to narrative text and displayed in one instance, such as in multiple sentences or multiple paragraphs. Optionally, entries are transfigured to narrative text and displayed sequentially, such as displaying one sentence or paragraph per screen. Optionally, the personalization engine personalizes text according to the student's relative language proficiency, be it a native or foreign language. Optionally, the personalization engine personalizes text according to the Lexile framework from MetaMetrics, or similar.

[00062] Optionally, the narrative comprises multimedia such as audio, video, virtual reality (VR), or image.

[00063] In one embodiment, the structured data is stored as JavaScript Object Notation (JSON). In another embodiment, structured data is stored as Yet Another Markup Language (YAML). In another embodiment, the structured data is stored in a relational database. Optionally, each entity is a database row.

[00064] In one embodiment, entities comprise a combination of structured syntax and natural language. For example, an entity might comprise "The [horse|steed] [walks|gallops]." This example associates synonymic words at different reading levels. Optionally, entities contain identifiers associated with human-readable words stored elsewhere.

[00065] In one embodiment, entities are stored as tuples. For example, a tuple represented in JSON-like syntax might be:

```
{
 object: [ horse, steed ],
 verb: [ walk, gallop ]
}
```

[00066] Optionally, entities comprise identifiers associated with words stored elsewhere. For example, the entity comprises an object ID associated with a tuple storing multiple synonyms for the desired object word:

```
{
 object: 1234,
 ...
}
{
 id: 1234,
 en_l1: horse,
 en_l2: steed,
 es_l1: caballo
}
```

[00067] In one embodiment, the structured data entities are derived from a pre-existing text, such as a novel or short story. Optionally, the entities are derived by applying natural language processing or a neural network to a pre-existing text. For example, a natural language processor is applied to Shakespeare's *Romeo and Juliet*, whereby an entity representing the character of Romeo and an entity representing the character of Juliet are extracted and stored in structured data.

[00068] In one embodiment, a student is presented with natural language text. The student is presented with a prompt to enter one or more pieces of information conveyed by the natural language text as structured text. The computer programmatically verifies the structured data.

[00069] In another embodiment, structured data stores characters, locations, and times. Media (including natural language text, images, and/or video) is

presented to the user. The media communicates a narrative personalized according to the user's selection. In one embodiment, the user selects a character and the media communicates a narrative of period of time in the character's life according to the structured data points related to that character. Optionally, the character is a historical figure and the data points relate to historical events – such as battles of Julius Caesar. In another embodiment, the user selects a location and a media narrative is constructed describing events which occurred in that location. For example, the user selects Paris, France and a narrative communicates chronologically great artists that have lived in Paris.

[00070] FIG. 8 illustrates a normalized report for answers to one assessment question. The report is laid out as a gradebook. Each row represents a student **8001**. Each column represents an assessment **8002** of the given question. Each center cell **8003** represents a normalized form of the student's answer to the question. In this embodiment, each student answered the question four times, over a period of time, each time the question was personalized to the student's reading level. Each answer starts with a 1-4 indicating the reading level of each question, followed by a Y for a correct answer or an N for an incorrect answer. Ideally, as a student progresses, they are presented with the same question personalized to increasingly higher reading levels. Rows indicate a student's progress over time. Columns indicate a cohort's abilities at a point in time. Answers are optionally represented on a number rubric, for example 1-4. Answers are optionally represented with letters, such as A-D. Answers are optionally represented as a percentage 0-100%. Answers are optionally color coded. Optionally, each answer cell represents a plurality of answers from an assessment.

[00071] FIG. 9 illustrates one embodiment wherein an assessment question **9002** is personalized by the personalization engine **1003** for each of a group of students **9001**. The answers are then normalized by a reporting engine **9004** to display a report **9005**. While each student answers a differently worded

question, the system identifies that the knowledge demonstrated by each answer is comparable.

[00072] In one embodiment, the personalization engine **1003** or the report engine **9004** applies a psychometric analysis to the answers (such as IRT) and adjusts the questions according. Optionally, the adjustment comprises modifying the question or possible answers. Optionally, the adjustment comprises removing a certain question from the assessment. Optionally, the adjustment comprises discounting a question from students' overall scores. Optionally, the adjustment is made automatically; alternatively, an adjustment recommendation is presented to the teacher. Optionally, the application of psychometric analysis comprises the use of neural networks, machine learning, and/or artificial intelligence.

[00073] FIG. 10 illustrates a cycle of computer assessment to educational item. A student **1001** completes an assessment **10002** in a computer interface such as a web browser or tablet application. The student's answers are processed by a recommendation engine **10003**, which then recommends the next educational item **10006** to either the student directly, or to a teacher to give to the student.

[00074] The recommendation engine **10003** comprises a combination of computer hardware and software, including a database of recommendable items **10005** and a correlation program **10004** that correlates answers (correct or incorrect) with recommendable items. In one embodiment, the correlation program **10004** comprises an algorithm written in conventional computer programming language. In another embodiment, the correlation program **10004** comprises a neural network. In another embodiment, the correlation program **10004** comprises a Bayesian algorithm. In one embodiment, the logic of the correlation program **10004** is derived manually by a human entering correlations; optionally, a human manually tags questions and items with educational standard codes such as those of Common Core. In another embodiment, the logic of the correlation program **10004** is derived

computationally from previous students' answers; optionally using statistical analysis or neural network training (optionally including backpropagation). In another embodiment, the logic of the correlation program **10004** is a combination of the above.

[00075] In one embodiment, the educational item **10006** is a print item, such as a worksheet. In one embodiment, the student **1001** (or teacher) prints the item locally. In another embodiment, the item **10006** is printed by a service provider and physically mailed to the student **1001**. This embodiment forms a print-to-digital loop wherein the student benefits from having a permanent digital assessment history and a computer recommendation engine, but also receives offline educational content so they are not required to excessively stare at a computer screen. Offline items are optionally scanned or photographed to be stored in a digital student portfolio. Items in the portfolio are optionally graded by computer vision and/or character recognition.

[00076] In another embodiment, the education item **10006** is digital media presented electronically such as an audio file (such as MP3), a webpage (such as HTML), video file (such as MP4), image file (such as JPEG), multimedia application (such as Flash or iOS app), a slideshow (such as PPT), or a document (such as PDF or DOC).

[00077] FIG. 11 illustrates a student assessment recorded on a blockchain. A student **1001** completes an assessment **10002** on a computer application. The computer application sends data packets over a computer network comprising data related to the student's assessment score and a cryptographic identifier. Typically, the cryptographic identifier comprises a public key, private key, cryptographic signature, or an associated string/integer. The packets are received by a network node participating in a blockchain **11002**. Information related to the student's assessment score and cryptographic signature are sent to other network nodes participating in the blockchain **11002** and the information is cryptographically written to a blockchain block **11003**. A second educational

application **11004** uses a student identifier (typically associated with a public key) to read the student's assessment score from the blockchain **11002**. The second educational application **11004** uses this score to present appropriate assessment, instruction, curriculum, courses, rewards, or other educational items to the student **1001**.

[00078] In one embodiment, the student **1001** earns on-blockchain rewards for completing assessments, such as tokens, cryptocurrency, or nonfungible tokens (NFTs).

[00079] FIG. 12 illustrates item-assessment cycle logic in an educational application. Optionally, this logic is used in the recommendation engine **10003** in FIG. 10. A student accesses a computer application such as a web browser, desktop program, iOS application, Android application, tablet application, mobile phone application, or similar. The application displays an educational item **10006** to the student, for example a video about dinosaurs. The application then presents the student with an assessment **10002** related to the item **10006**, for example asking multiple choice or fill-in-the-blank questions about dinosaurs. The student answers the assessment questions. The application determines if the student passes the assessment **12003**. If *PASS* **12005**, the application presents the student with the next item. If *FAIL* **12004**, the application presents the student with a remedial item. The cycle then restarts. In one embodiment, the application presents a general remedial item indicating that that the student did not pass the assessment. In another embodiment, the application presents a remedial item based on one or more selected incorrect answers, wherein the item specifically addresses the student's presumed incorrect thought process. In another embodiment, the application redisplays the initial item as the remedial item. In another embodiment, the application displays a combination of the remedial items described above.

[00080] In one embodiment, the item **10006** is a narrative video and the assessment **10002** is personalized to match the video narrative.

[00081] FIG. 13 illustrates a computer program personalizing a educational print item for a student. A computer accesses a generic education item **1002,** for example a printable worksheet. Optionally, the item **1002** is selected by a student/teacher in a graphical user interface. At block **1003**, the personalization engine combines the generic item **1002** with an appropriate context settings **1005**, for example *baseball* or *dinosaurs*. At block **13003**, the presentation engine uses printer settings **13006** (for example *full color*, *grayscale*, *minimal black-and-white*) to modify the generic item **1002** or subselect an associated generic item matching the print settings **13006**. At block **13004** the computer program generates a print item which is then printed using an electronic computer printer. In one embodiment, the computer program stores default context settings **1005** and print settings **13006** for the user so that the user need not reselect those upon every printing. Optionally, user default settings are stored in a web browser cookie, local computer storage, or in a server database row associated with the user's account.

[00082] FIG. 14 illustrates an assessment-recommendation-personalization cycle. A student **1001** completes an electronic assessment **10002**. Based on the assessment score, a recommendation engine **10003** selects an appropriate generic educational item **1002**. The generic educational item is personalized **1003**. The personalized item **1004** is presented to the student. The student **1001** completes the personalized item **1004** and the cycle starts again. In one embodiment, the personalized item **1004** is a print item such as a worksheet or workbook. Optionally, the print item is printed on a home printer, or alternatively, printed by a service that mails the item to the student. Optionally, the mailing is done periodically, such as weekly, monthly, or quarterly.

[00083] FIG. 15 illustrates a multisubject assessment-recommendation-combination cycle. A student **1001** is assessed on a first subject **10002**. A recommendation engine **10003** processes the student's answers to select an appropriate first subject item **10006** according to the student's assessed

knowledge of the first subject. The student **1001** is assessed on a second subject **10002B**. The recommendation engine **10003** processes the student's answers to select a second subject item **10006B** according to the student's assessed knowledge of the second subject. The first subject item **10006B** and the second subject item **10006B** are combined to form a combined item **15006** that is presented to the student.

[00084] Example subjects include addition, algebra, astronomy, biology, calculus, division, history, language, math, multiplication, physics, reading, subtraction, trigonometry, writing, and similar.

[00085] In one embodiment, the assessment comprises two events, one for each subject. In another embodiment, the assessment comprises one event which assesses the students on both subjects; for example, alternating questions between math and language.

[00086] In one embodiment, the combined item **15006** is printed on a print medium.

[00087] In one embodiment, two subject files are combined into one file before printing; for example, an addition worksheet PDF file is combined with a language fill-in-the-blank worksheet PDF file to form a printable combined workbook PDF file. Optionally, the combined item **15006** is printed locally by the student or teacher; alternatively, the combined item **15006** is printed by a service that physically mails the combined item **15006** to the student or teacher.

[00088] In another embodiment, two subject files are each sent electronically to a printing service that prints both and bundles them into one combined package, which is then mailed to the student; for example, the printing service prints an addition worksheet PDF file, then prints a language fill-in-the-blank worksheet PDF, then places the two in an envelope to be mailed to the student. In this embodiment, the package constitutes a combined item **15006**. Packages include envelopes, boxes, folders, binders, and similar.

PREFERRED COMPONENTS OF THE INVENTION

[00089] The following are some of the preferred components variously used in certain embodiments of the present invention. Additional components not listed here are used in certain embodiments.

[00090] *Application Programming Interface (API)* is a connection between computer programs wherein one program offers a known a service to another program. API programs may be located on the same computer, or may be located on disparate computers connected by a network. An example network API design is REST.

[00091] *Assessment* is the process of evaluating a student's subject knowledge. A typical assessment is in a question-answer form such as multiple choice or fill-in-the-blank. Assessments may be administered orally, in writing, or on a computing device (e.g. a desktop or tablet). A placement assessment is typically administered in the beginning of a term in order to select a curriculum or class for a student. A formative assessment is typically administered periodically intraterm in order to assess the student's progress. A summative assessment is typically administered at the end of a term to formally determine a student's progress over the term. Specific assessments may be required by certain authorities, for example state standardized tests such as California's Standardized Testing and Reporting (STAR); or college admissions tests such as the Scholastic Assessment Test (SAT), American College Testing (ACT), Law School Admission Test (LSAT), Graduate Record Examination (GRE), or Graduate Management Admission Test (GMAT).

[00092] *Audio* computer file formats include 3GP, AA, AAC, MP3 OGG, WAV, WMA, WEBM, and similar.

[00093] *Blockchain* is a list of records linked cryptographically and stored on a computer network. Constituent records are called blocks and typically comprise

a cryptographic hash of the previous block and a timestamp. Example blockchains include Bitcoin, Ethereum, Polygon, Binance, Ripple, Cardano, Solana, Polkadot, Near, Avalanche, Litecoin, Monero, Arbitrum, Optimism, Lightning Network, and similar. Blockchains known as Layer-1 blockchains exists independently, blockchains known as Layer-2 are dependent on Layer-1 blockchains.

[00094] *Blockchain smart contract* is a computer program that is automatically executed by nodes of a blockchain network. Example blockchains that utilize smart contracts include Ethereum and Solana.

[00095] *Blockchain address* is a string associated with a public-private keypair for a user on a blockchain. Blockchain addresses are commonly represented as hexadecimal strings such as `0x1234ABC`. Blockchain smart contracts are typically assigned a unique blockchain address to which users send messages to execute the program.

[00096] *Blockchain token* or *coin* or loosely *cryptocurrency* is a mathematical representation of asset ownership on a blockchain. Example Ethereum token types include ERC-20 fungible tokens, ERC-721 non-fungible tokens, and ERC-1155 semi-fungible tokens. Creation of a token is termed *minting*, destruction of a token is termed *burning*.

[00097] *Bonding Curve* is a mathematical concept used to describe the relationship between price and the supply of an asset.

[00098] *Cascading Style Sheets (CSS)* is a style sheet language used for describing the presentation of a document written in a markup language such as HTML.

[00099] *Classical test theory (CTT)* is an approach that is based on simple mathematics; primarily averages, proportions, and correlations.

[000100] *Client* is a computer initiating a request to a server computer over a network.

[000101] *Cloud computing* is a method of granting on-demand control of a computer to a user over a network.

[000102] *Cloud provider* is a legal person offering cloud computing. Example cloud providers include Amazon Web Services, Google Cloud, and Microsoft Azure.

[000103] *Cloud storage* is a special case of cloud computing focused on offering on-demand storage and network transmission of data.

[000104] *Code generator* is a computer program that receives a specification and outputs a computer program. The output program may be encoded in a programming language, assembly language, machine code, object code, byte code, or other binary code.

[000105] *Common Core* is a set of US K-12 educational standards for math and language arts detailed at `www.corestandards.org`.

[000106] *Computer*, or *computing device* or *computing system*, is a physical device comprising at least one computer-readable storage medium and at least one processor. A computer typically operates by reading input data from a computer-readable storage medium, reading instructions from a computer readable storage medium, and executing the input data and instructions with the processor to produce output data. Output data is typically stored in a computer-readable storage medium and/or outputted to a user. Computer form factors include desktops, laptops, smart phones, smart watches, and servers.

[000107] *Computer-readable storage medium (CRSM),* or *computer data storage medium,* or *storage*, is a physical device containing input data and/or instructions for use by a computer. Common CRSMs include hard drives

(HDD), solid state drives (SSD), flash drives, tape drives, magnetic tape, Compact Discs (CD), Digital Video Discs (DVD), Blue-rays, optical drives, floppy disks, zip drives, random access memory (RAM), read only memory (ROM), and punch cards.

[000108] *Context* is media associated with an educational item. Example contexts include: athletes, baseball, basketball, buildings, celebrities, dinosaurs, equipment, fairy tales, farm animals, fictional animals (e.g. unicorns), fictional characters, fictional locations, fictional stories, football, geographic locations, heavy machinery, historical figures, insects, occupations, outer space, planets, religious figures, religious iconography, rockets, soccer, sports, stars, tennis, wild animals, zoo animals, and similar.

[000109] *Create/Read/Update/Delete (CRUD)*, or *manipulate*, are the four basic operations on stored data. In SQL, these terms map to INSERT, SELECT, UPDATE, and DELETE. In HTTP, these terms map to POST, GET, PUT, DELETE.

[000110] *Cryptography* is the practice and study of techniques for secure communication in the presence of adversarial behavior. In computer science, common cryptographic techniques include Diffie-Hellman, X.509, Rivest-Shamir-Adleman (RSA), and Elliptic-curve cryptography (ECC), and Elliptic Curve Digital Signature Algorithm (ECDSA).

[000111] *Database (DB)*, or *computer database*, is an organized set of data stored on a computer-readable storage medium for manipulation by a database program.

[000112] *Database Management System (DBMS)*, or *database program* or *database software*, is a special case program to manipulate a database. Example database management systems include MySQL, Microsoft Access, SQLite, PostgreSQL, MariaDB, Couchbase, Redis, MongoDB, and HBase.

[000113] *Database cell*, or *cell*, is the value of one row at one column in a database table.

[000114] *Database column*, or *column*, is a set of values of a particular type, with each row having one value per column in a table.

[000115] *Database row*, or *row* or *tuple*, is an entry in a database table comprising one value per column of the table.

[000116] *Domain name* is an identification string that defines a realm of administrative authority within the Internet. Domain names are used in various networking contexts and for application-specific naming and addressing purposes. Generally, a domain name points to a server at a given IP address. An example domain name is `namechain.com`.

[000117] *Domain Name System (DNS)* is a hierarchical and decentralized naming system for computers, services, or other resources connected to the Internet or a private network. DNS is associated with internet protocols including DNS, DNS-over-UDP, DNS-over-TCP, DNSCrypt, DNS-over-TLS, DNS-over-HTTPS, DNS-over-TOR, and Oblivious DNS-over-HTTPS.

[000118] *Domain name record* is a record associated with a domain name, including nameserver records, DNS records, Auth Codes, registrant information, registrant account identifiers, and WHOIS records.

[000119] *Download* is the transmission of data from a server computer to a client computer over a network.

[000120] *Educational item* is a text block, worksheet, book, web page, video file, audio file, app screen, document, virtual reality object, multimedia file, or other medium used to instruct or assess a student.

[000121] *Ethereum Improvement Proposal (EIP)* is a prefix for Ethereum standards, followed by a number, such as EIP-165.

[000122] *Ethereum Request for Comments (ERC)* is a prefix for Ethereum standards, followed by a number, such as ERC-20.

[000123] *ERC-20* is a free, open standard that describes how to build fungible tokens on the Ethereum blockchain.

[000124] *ERC-721* is a free, open standard that describes how to build non-fungible or unique tokens on the Ethereum blockchain.

[000125] *ERC-1155* is a free, open standard that describes how to build semi-fungible or unique tokens on the Ethereum blockchain.

[000126] *Ethereum* is a blockchain network with smart contract functionality developed in 2014 by Vitalik Buterin and others.

[000127] *Ethernet* is a family of wired computer networking technologies commonly used in local area networks (LAN), metropolitan area networks (MAN) and wide area networks (WAN).

[000128] Extensible Provisioning Protocol (EPP) is an XML-based protocol designed for domain registrars to update domain name records in the domain name registry.

[000129] *Evidence-based education* (EBE) is the principle that education practices should be based on the best available scientific evidence, rather than tradition, personal judgement, or other influences.

[000130] *Flashcard*, or *flash card*, is a card bearing information on both sides, which is intended to be used as an aid in memorization. Digital flashcards typically simulate this idea by using two screens: a front screen and a back screen.

[000131] *Hardware,* or *computer hardware*, is the collection of physical devices comprising a computer.

[000132] *Hash function*, or *hash*, is a function that converts input data of arbitrary size to an output value of fixed size. Hashes are often used in checksums, check digits, fingerprints, lossy compression, randomization functions, error-correcting codes, and ciphers. Hashes may be implemented by software, hardware, or both. Example hash functions include Keccak, Secure Hash Algorithm (SHA), Message-Digest Algorithm 5 (MD5), RIPE Message Digest (RIPEMD), Whirlpool, BLAKE, and Cyclic Redundancy Check 32 (CRC32).

[000133] *HTTP cookie*, or *cookie*, is a piece of data stored on a client computer used for storing state information when communicating with a server. Typically, cookies are handled by web browsers.

[000134] *Hyperpiler* is a code generator described in U.S. Patent Number 10,942,709 and related documents.

[000135] *Hyperplexer* is a multitenant server described in U.S. Patent Application Number 17/542,442 and related documents.

[000136] *HyperText Markup Language (HTML)*, is the standard markup language for displaying documents in a web browser.

[000137] *Image* computer file formats include BMP, GIF, JPEG, PNG, SVG, and similar.

[000138] *Input device* is a physical device which initiates a computer execution. Such execution includes storing data, storing instructions, and/or selecting instructions and data to execute in the future. Input devices include computer keyboards, keypads, computer mice, touch screens, microphones, cameras, card readers, scanners, bar code readers, chip readers, magnetic tape readers, network modem (wired or wireless), and Bluetooth receiver.

[000139] *Internet* is the global system of interconnected computer networks that uses the TCP/IP protocol to communicate.

[000140] *Internet Protocol Address (IP address)*. A unique number identifying a computer connected to the Internet. Internet Protocol version 4 (IPv4) addresses comprise 32 bits. Internet Protocol version 6 (IPv6) addresses comprise 128 bits.

[000141] *Item Response Theory (IRT)* is a paradigm for the design, analysis, and scoring of assessments.

[000142] *Linux* is a family of open-source Unix-like operating systems based on the Linux kernel first released on September 17, 1991, by Linus Torvalds.

[000143] *Likert scale* is a psychometric scale commonly involved in research that employs questionnaires.

[000144] *Markup language* is a syntax for annotating a document in a way that is visually distinguishable from the content. Markup languages typically do not contain executable instructions. Example markup languages include HTML, LaTeX, and Markdown.

[000145] *Microprocessor* is a special case processor that converts a digital electric input signal into a digital electric output signal through a clock-driven integrated circuit comprising logic gates. Example commercial microprocessors include the Intel 4004, the Intel Pentium line, the IBM PowerPC line, the and the Motorola 68000.

[000146] *Multimedia file* includes DOC, PDF, PPT, FLV, HTML, and similar.

[000147] *Network* is two or more computers comminating. Network data may be sent as electric pulses over copper wire, light pulses over optical fiber, and/or radio waves over the air.

[000148] *Network protocol* is a predefined signal syntax allowing two computers to communicate over a network. Protocols may be implemented by software, hardware, or both. Protocols are typically "layered," wherein more specific protocols are transmitted within more generic protocols. Example protocols include Address Resolution Protocol (ARP), Internetwork Packet Exchange (IPX), Transmission Control Protocol (TCP), Internet Protocol (IP), User Datagram Protocol (UDP), HyperText Transfer Protocol (HTTP), Secure Socket Layer (SSL), Transport Layer Security (TLS), File Transport Protocol (FTP), Secure File Transport Protocol (SFTP), Secure Shell (SSH), Telnet, Domain Name System (DNS). Internet Control Message Protocol (ICMP), NetBIOS, Remote Procedure Call (RPC), Internet Relay Chat (IRC), Network Time Protocol (NTP), Internet Message Access Protocol (IMAP), Post Office Protocol (POP), and Simple Mail Transfer Protocol (SMTP).

[000149] *Network router*, or *router*, is a networking device that forwards data packets between computer networks. A router may itself be a computer.

[000150] *Network switch*, or *switch* or *switching hub* or *bridging hub*, is a networking device that connects other devices on a computer network by using packet switching to receive and forward data to the destination device.

[000151] *Non-Fungible Token (NFT)* is a unique and non-interchangeable unit of data stored on a blockchain. NFTs use a digital ledger to provide a public certificate of authenticity or proof of ownership. The lack of interchangeability (fungibility) distinguishes NFTs from blockchain cryptocurrencies, such as Bitcoin.

[000152] *Open source* describes a software program that is made freely available for possible modification and redistribution.

[000153] *Personalization* is the process of modifying education items to meet the learning needs, preferences, and interests of a student. Both instruction and

assessment items may be personalized. Personalization encompasses contextualization, differentiation, and/or individualization. This includes modifying themes such as astronomy, sports, animals, music, movies, geography ecology, colors, and technology; difficulty such as reading level; presentation such as words, numbers, or symbols; names such as the student's name or student's friends' names; and media such as text, audio, video, image, and virtual reality.

[000154] *Print medium*, or *print media* or *print item*, is an object with physical markings. Markings are typically made by a computer-connected printer. Markings typically comprise letters, numbers, or graphics. Print media includes paper sheets, books, booklets, flashcards, plastic sheets, trading cards, playing cards, folders, binders, worksheets, workbooks, magazines, comic books, newspapers, and similar.

[000155] *Processor* is a physical device that deterministically executes input signals into output signals. Signals are typically electric. Signals may be digital or analog.

[000156] *Program*, or *computer program* or *computer application* or *application* or *piece of software* or *app*, is a distinct document of software. A program may reference and execute other programs. Example programs include Microsoft Word, WordPress, Apple iOS, and SQLite.

[000157] *Program specification*, or *specification*, is a data document describing the desired function of a computer program. A specification is typically processed by a code generator to output a computer program. Example specification encoding syntaxes include UML, XML, and JSON.

[000158] *Programming Language* is a formal language comprising a set of strings that instruct a computer processor. There are a number of programming languages, each having a specific syntax to encode instructions. Programming languages are typically compiled to machine code for execution at the

processor. Example programming languages include: ASP, BASIC, C, C#, C++, COBOL, Erlang, Go, Haskell, Java, JavaScript, Lisp, Objective-C, Perl, Python, PHP, Ruby, Rust, Scala, Solidity, and Vyper.

[000159] *Psychometrics* is a field of study within psychology concerned with the theory and technique of measurement.

[000160] *Relational Database Management System (RDBMS)* is a special case database management system using tuple principles.

[000161] *Representational state transfer (REST)* is an API design in which a client sends an HTTP request to a server which responds with structured data in XML, JSON, similar format.

[000162] *Scaling*, in social science, is the process of measuring or ordering entities with respect to quantitative attributes or traits.

[000163] *Server,* or *web server* or *network server,* is a special case computer optimized for receiving requests and sending responses over a computer network.

[000164] *Simple Query Language (SQL)* is a domain-specific computer language for manipulating data in a relational database management system.

[000165] *Social networking service,* or *social network*, is a computer program storing relationships between users, typically including features such as messaging, blogging, or picture uploading. Such services include Blogger, Chess.com, ClassDojo, Discord, Facebook, GitHub, Instagram, Medium, Pintrest, Quora, Reddit, Remind, Snapchat, StackOverflow, Steam, Telegram, TikTok, Twitch, Twitter, WeChat, WhatsApp, Wikipedia, Yammer, YouTube, and similar.

[000166] *Software*, or *computer software* or *computer code* or *code*, is data and instructions stored on the computer-readable storage medium of a computer to be executed by the processor.

[000167] *Solidity* is a smart contract programming language widely used on the Ethereum network.

[000168] *Spaced repetition* is a learning technique whereby more difficult items are shown more frequently, while older and less difficult items are shown less frequently in order to exploit the psychological spacing effect. This method is often used with flashcards.

[000169] *Spreadsheet* is a document containing human-readable data structured in rows and columns.

[000170] *Spreadsheet program* is a special case program for manipulating spreadsheets.

[000171] *Student* is a person receiving knowledge. A student may attend preschool, K-12 school, university, college, vocational training center, or similar. A student may be a prisoner at a correctional facility. A student may be an employee, intern, contractor, or trainee at an organization. A student may be a customer of an organization. A student may be enrolled in a certification program. Alternate terms for student include pupil and learner.

[000172] *Teacher* is a person guiding a student's learning. A teacher may be employed as a preschool teacher, K-12 teacher, a K-12 administrator, a university professor, a researcher, a corrections officer, a corporate trainer, proctor, tutor, teaching assistant, or similar. A teacher may be a parent, grandparent, guardian, or similar. Alternate terms for teacher include instructor, educator, and professor.

[000173] *Tuple* is a data structure comprising a list of elements. Types of tuples include enumerated arrays.

[000174] *Uniform Resource Locator (URL)*, or web address, is a reference to a web resource that specifies its location on a computer network and a mechanism for retrieving it. A typical URL has the form `http://www.example.com/index.html`, which indicates a protocol (http), a hostname (www.example.com), and a file name (index.html).

[000175] *Unix* is a family of multitasking, multiuser computer operating systems that derive from the original AT&T Unix, whose development started in the 1970s at the Bell Labs research center by Ken Thompson and Dennis Ritchie.

[000176] *User* is a distinct entity initiating an execution on a computer. Typically, a user is a human interacting with an input device. Alternatively, a user is a second computer programmed to interact with the first computer.

[000177] *Vertical scaling* is the process of placing scores from educational assessments measuring same/similar knowledge domains but at different ability levels onto a common scale.

[000178] *Video* computer file formats include 3GP, AVI, FLV, GIF, MOV, MP2, MP4, WEBM, WMV, and similar.

[000179] *Virtual Machine* is the virtualization/emulation of a computer system. Virtual machines are based on computer architectures and provide functionality of a physical computer. Their implementations may involve specialized hardware, software, or a combination.

[000180] *Web browser*, or *browser* or internet *browser*, is a program for browsing the World Wide Web. A typical browser function is to download and render a webpage comprising HTML, JavaScript, and/or CSS. Example web browsers

include Microsoft Internet Explorer, Microsoft Edge, Google Chrome, Apple Safari, and Mozilla Firefox.

[000181] *Web host* is a special case cloud provider specializing in serving documents on the World Wide Web.

[000182] *Web page*, or *webpage*, is an HTML document on the World Wide Web.

[000183] *Web site*, or *website*, is a group of related web pages controlled by one legal person.

[000184] *WHOIS* is a query-response protocol for accessing public domain name information, including the registrar and the registrant.

[000185] *Word processor* is a program for humans to compose human-readable documents.

[000186] *World Wide Web (WWW)*, or *the web*, is an information network of hyperlinked documents transmitted from web servers to client web browsers over the Internet using the HTTP protocol invented by Sir Timothy Berners-Lee in 1989 at CERN. Transmitted documents typically comprise HTML, CSS, and JavaScript.

[000187] *Zero-Knowledge Proof*, or *ZK proof*, is a method by which one party (the prover) can prove to another party (the verifier) that a given statement is true while the prover avoids conveying any additional information apart from the fact that the statement is indeed true. A non-interactive zero-knowledge proof requires no interaction between the prover and verifier. These cryptographic techniques are used to bundle transactions on blockchains. Examples include NIZK, zk-SNARK, and zk-STARK.

Claims

1. A computer-implemented method for generating a personalized educational item, the method comprising:

receiving a context selection from a plurality of possible context selections;

accessing a media item associated with the context selection;

accessing an educational item;

combining the media item and the educational item to form a personalized educational item; and

presenting the personalized educational item to the user.

2. The computer-implemented method of Claim 1, wherein presenting to the user comprises printing the personalized educational item on a printable medium.

3. The computer-implemented method of Claim 2, further comprising printing the physical mailing address of the user on a printable medium.

4. A computer-implemented method for generating a personalized educational item, the method comprising:

receiving a plurality of social network connections for a user, each connection comprising at least a name;

accessing an educational item;

combining the educational item and at least one name of one social network connection of the plurality of social network connections to form a personalized educational item; and

presenting the personalized educational item to the user.

5. The computer-implemented method of Claim 4, wherein the plurality of social network connections is received from the Application Programming Interface (API) of a social networking service.

6. A computer-implemented method for generating a combined educational item, the method comprising:

assessing a user on a first subject;

assessing a user on a second subject;

selecting a first educational item related to the first subject according to the results of assessing the user on the first subject;

selecting a second educational item related to the second subject according to the results of assessing the user on the second subject;

combining the first educational item and the second educational item into a combined educational item; and

presenting the combined educational item to the user.

7. The computer-implemented method of Claim 6, wherein presenting to the user comprises printing the combined educational item on a printable medium.

8. The computer-implemented method of Claim 7, further comprising printing the physical mailing address of the user on a printable medium.

9. A non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a personalized educational item by:

receiving a context selection from a plurality of possible context selections;

accessing a media item associated with the context selection;

accessing an educational item;

combining the media item and the educational item to form a personalized educational item; and

presenting the personalized educational item to the user.

10. The non-transitory computer-readable storage medium of Claim 9, wherein presenting to the user comprises printing the personalized educational item on a printable medium.

11. The non-transitory computer-readable storage medium of Claim 10, further storing instructions for printing the physical mailing address of the user on a printable medium.

12. A non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a personalized educational item by:

receiving a plurality of social network connections for a user, each connection comprising at least a name;

accessing an educational item;

combining the educational item and at least one name of one social network connection of the plurality of social network connections to form a personalized educational item; and

presenting the personalized educational item to the user.

13. The non-transitory computer-readable storage medium of Claim 12, wherein the plurality of social network connections is received from the Application Programming Interface (API) of a social networking service.

14. A non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a combined educational item by:

assessing a user on a first subject;

assessing a user on a second subject;

selecting a first educational item related to the first subject according to the results of assessing the user on the first subject;

selecting a second educational item related to the second subject according to the results of assessing the user on the second subject;

combining the first educational item and the second educational item into a combined educational item; and

presenting the combined educational item to the user.

15. The non-transitory computer-readable storage medium of Claim 14, wherein presenting to the user comprises printing the combined educational item on a printable medium.

16. The non-transitory computer-readable storage medium of Claim 15, further storing instructions for printing the physical mailing address of the user on a printable medium.

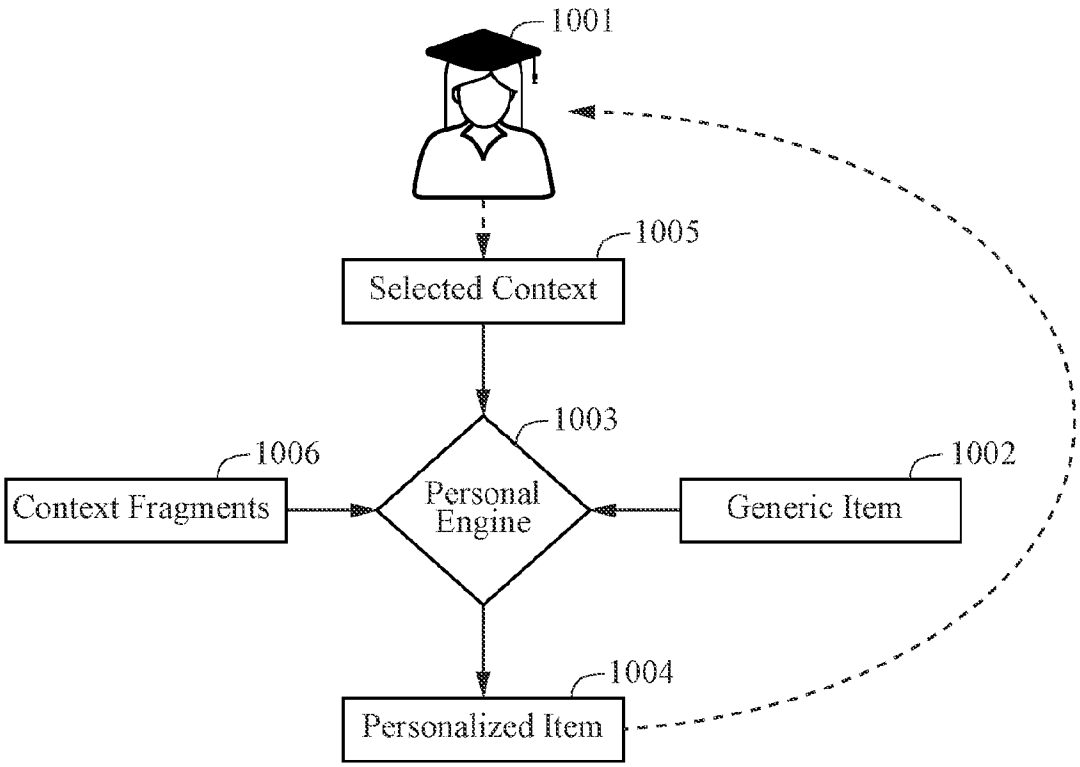
1001
1005
Selected Context
1003
1006
Context Fragments
Personal Engine
1002
Generic Item
1004
Personalized Item

FIG. 1

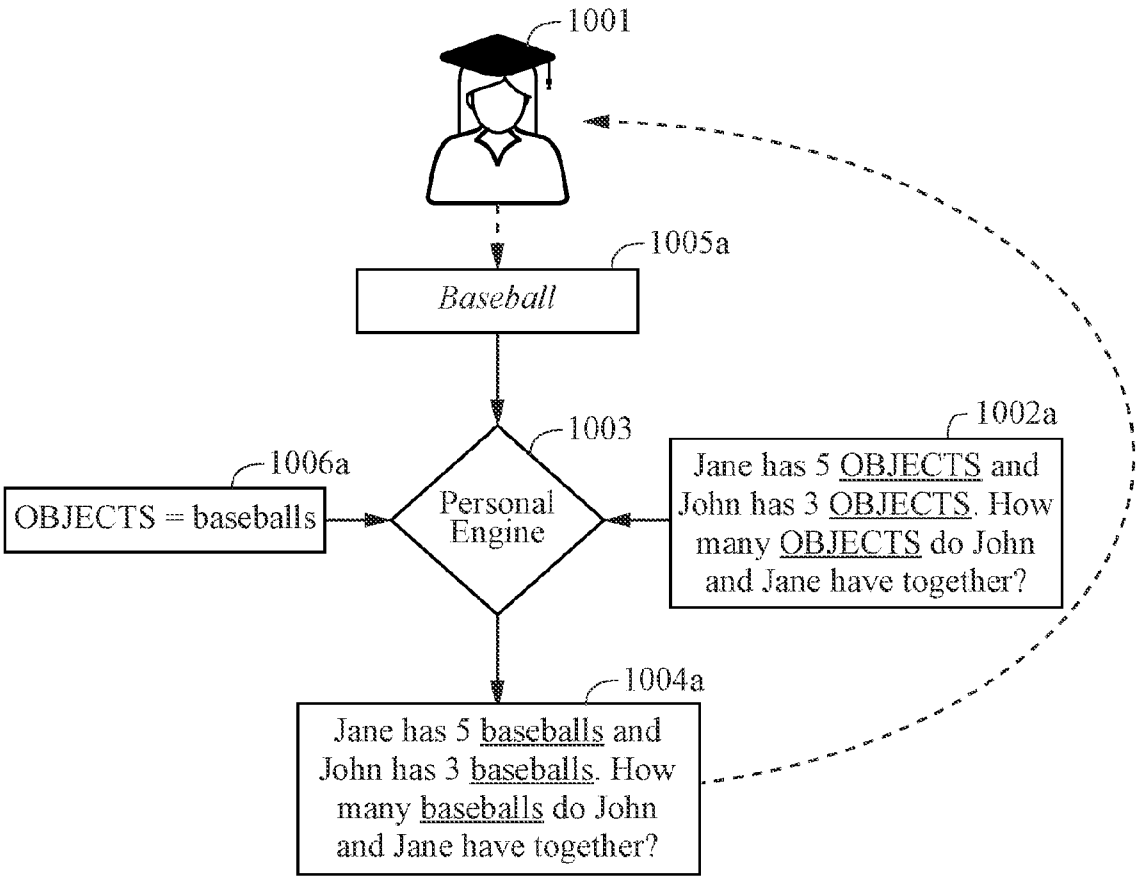
1001
1005a
Baseball
1003
1002a
1006a
OBJECTS = baseballs
Personal Engine
Jane has 5 OBJECTS and John has 3 OBJECTS. How many OBJECTS do John and Jane have together?
1004a
Jane has 5 baseballs and John has 3 baseballs. How many baseballs do John and Jane have together?

FIG. 1A

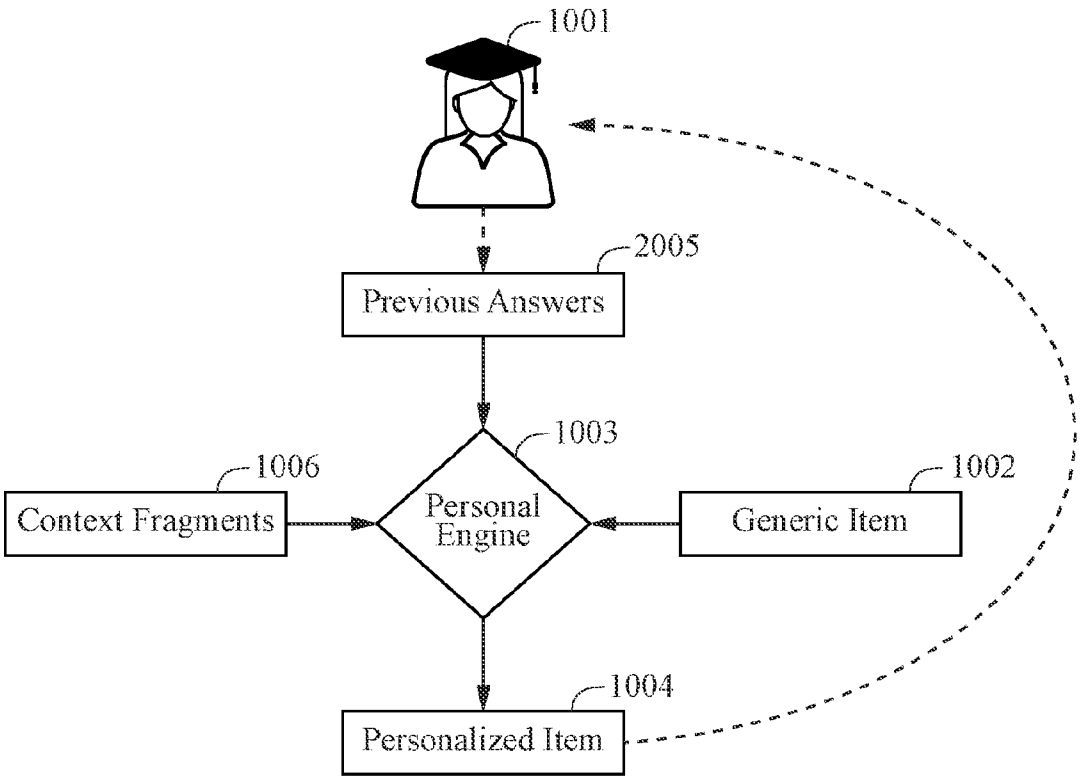
1001
2005
Previous Answers
1003
1006
Context Fragments
Personal Engine
1002
Generic Item
1004
Personalized Item

FIG. 2

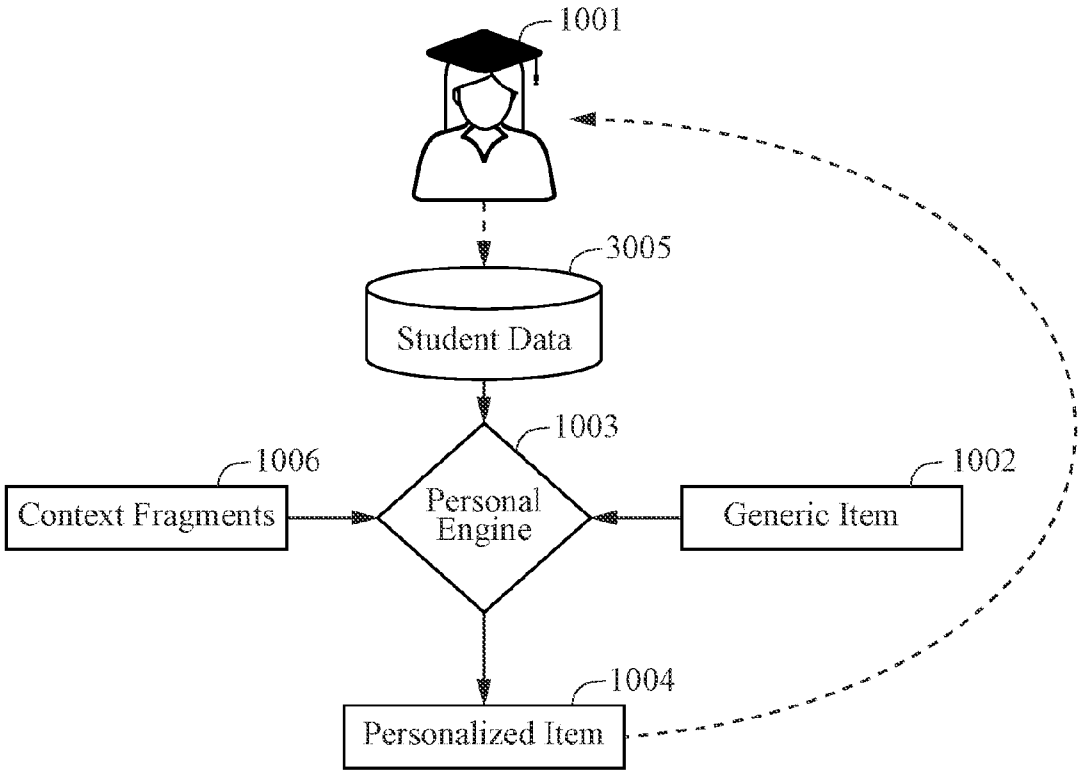
1001
3005
Student Data
1003
1006
Context Fragments
Personal Engine
1002
Generic Item
1004
Personalized Item

FIG. 3

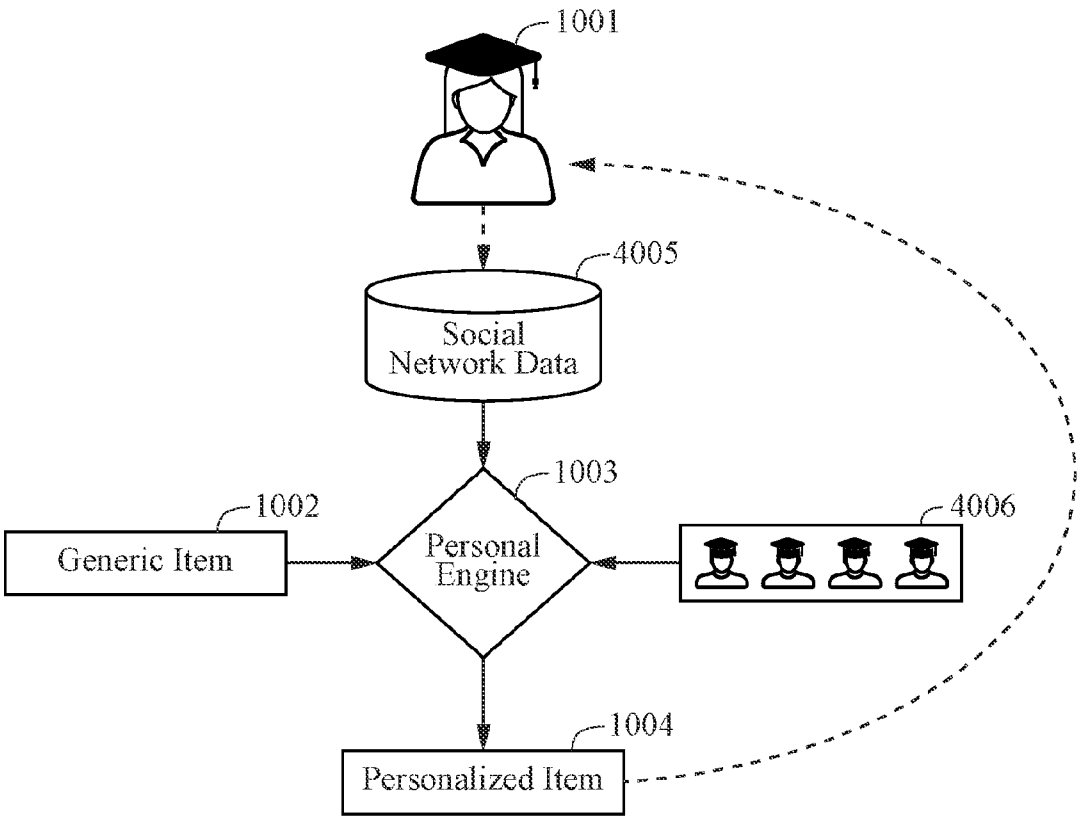
1001
4005
Social Network Data
1003
1002
Generic Item
Personal Engine
4006
1004
Personalized Item

FIG. 4

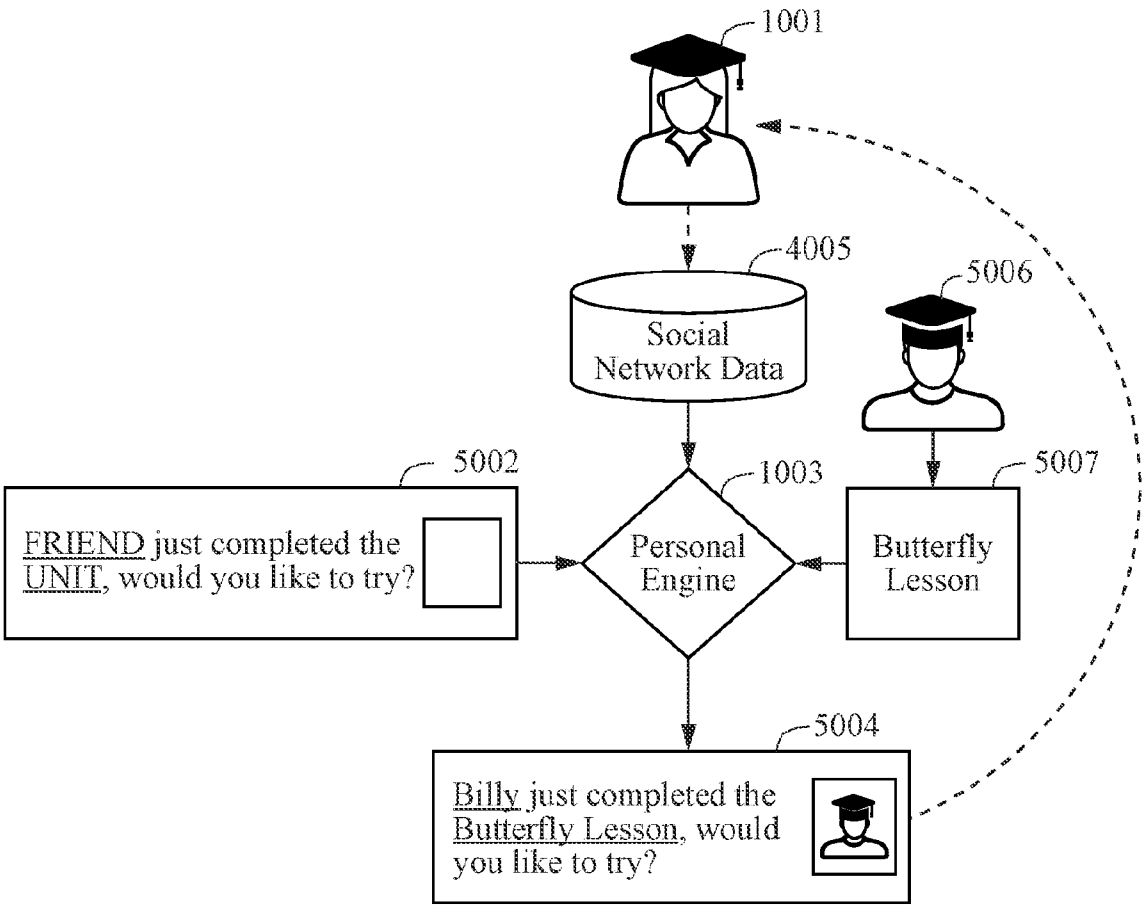
1001
4005
Social Network Data
5006
5002
1003
5007
FRIEND just completed the UNIT, would you like to try?
Personal Engine
Butterfly Lesson
5004
Billy just completed the Butterfly Lesson, would you like to try?

FIG. 5

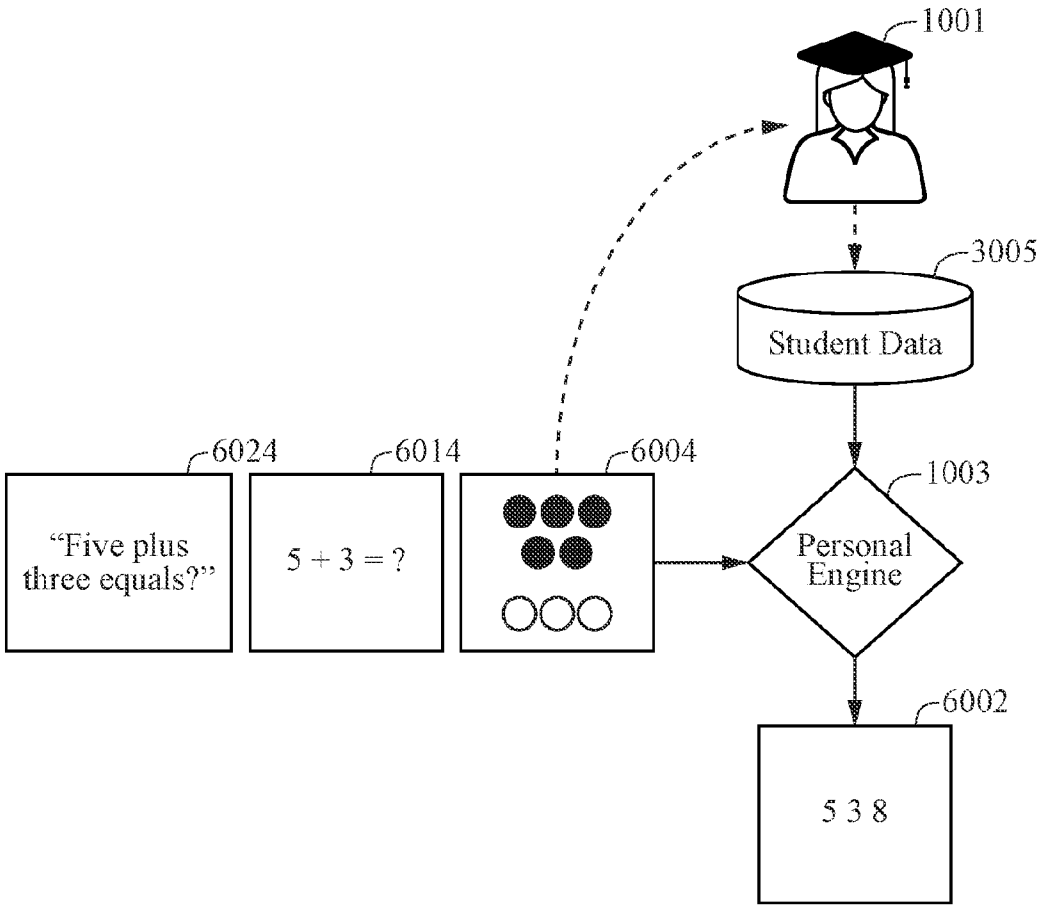
1001
3005
Student Data
6024
6014
6004
1003
"Five plus three equals?"
5 + 3 = ?
Personal Engine
6002
5 3 8

FIG. 6

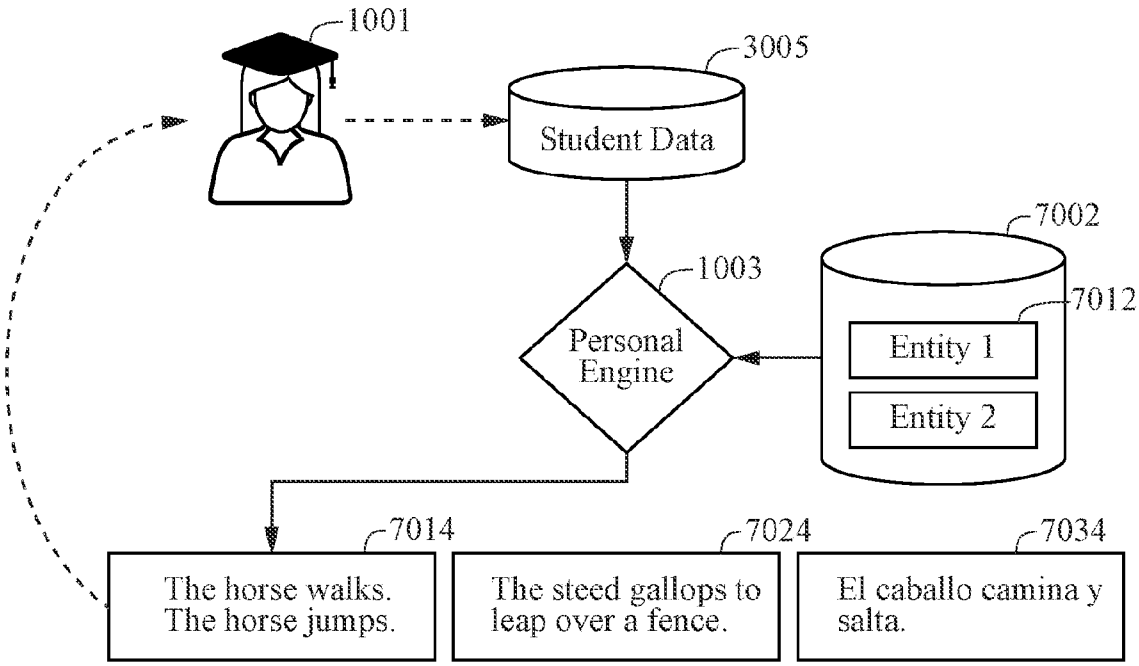
1001
3005
Student Data
7002
1003
7012
Personal Engine
Entity 1
Entity 2
7014
7024
7034
The horse walks. The horse jumps.
The steed gallops to leap over a fence.
El caballo camina y salta.

FIG. 7

	First	Second	Third	Fourth
	1Y	1Y	2N	2Y
	2Y	4N	3Y	3Y
	2Y	2Y	3Y	4Y
	1Y	2N	2N	2Y

FIG. 8

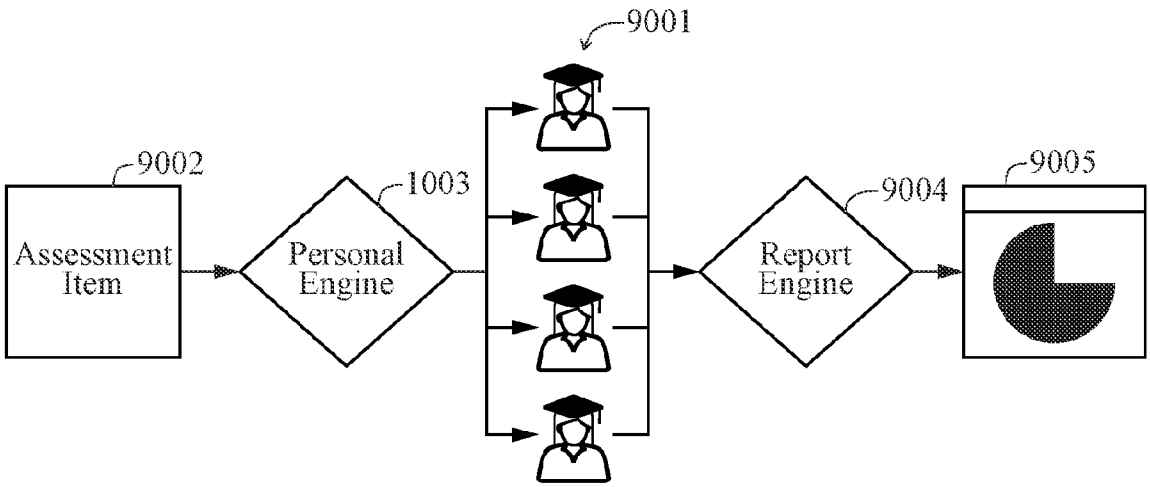
9001
9002
Assessment Item
1003
Personal Engine
9004
Report Engine
9005

FIG. 9

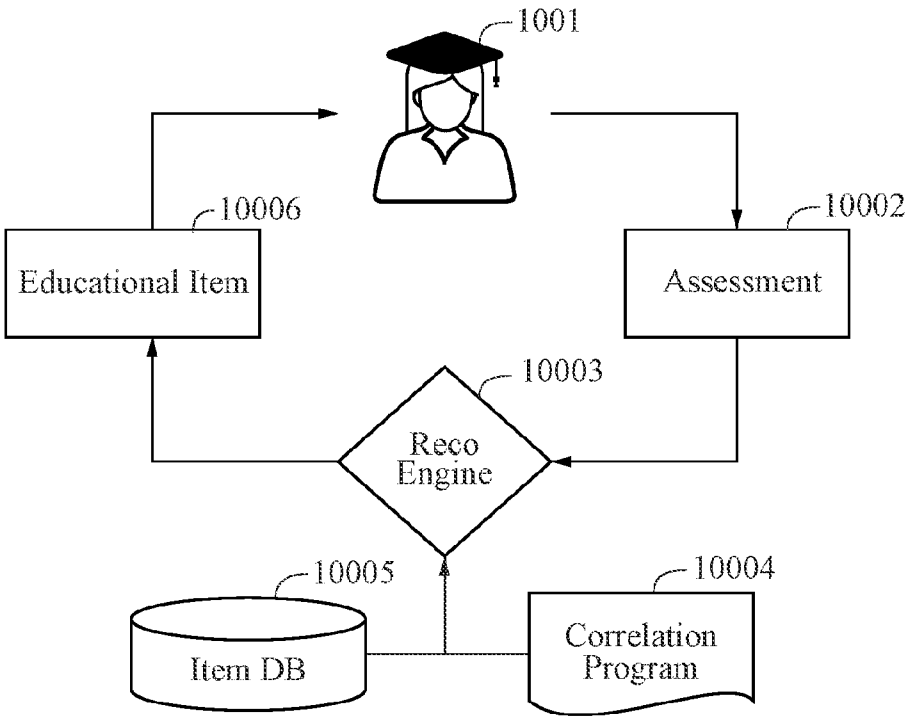
1001
10006
Educational Item
10002
Assessment
10003
Reco Engine
10005
Item DB
10004
Correlation Program

FIG. 10

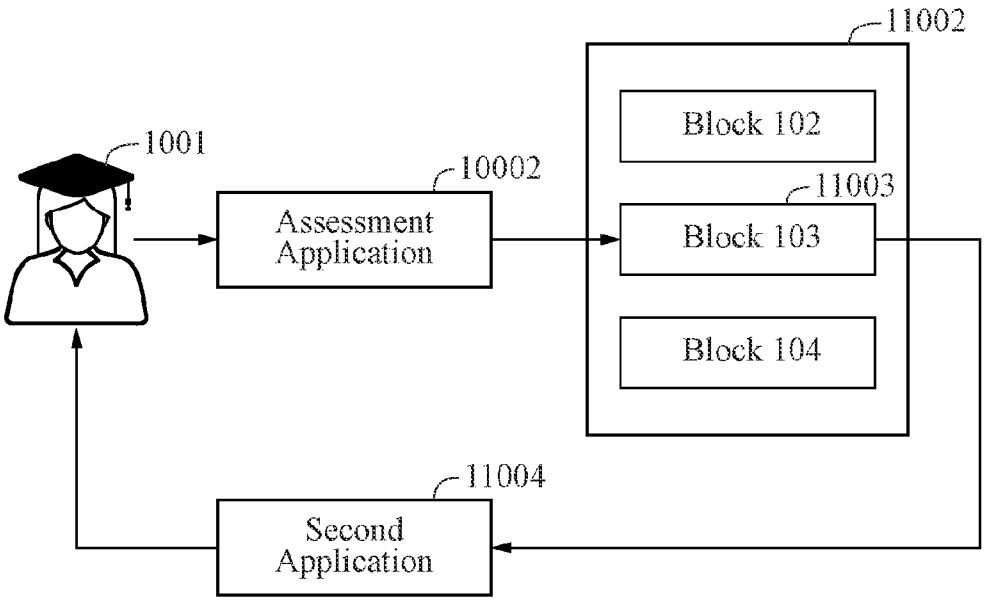
11002
Block 102
1001
10002
11003
Assessment Application
Block 103
Block 104
11004
Second Application

FIG. 11

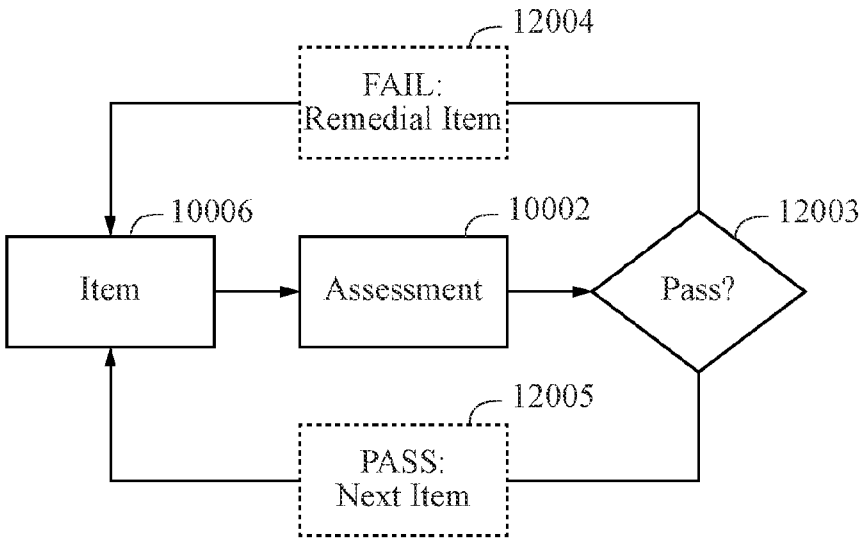
12004
FAIL:
Remedial Item
10006
10002
12003
Item
Assessment
Pass?
12005
PASS:
Next Item

FIG. 12

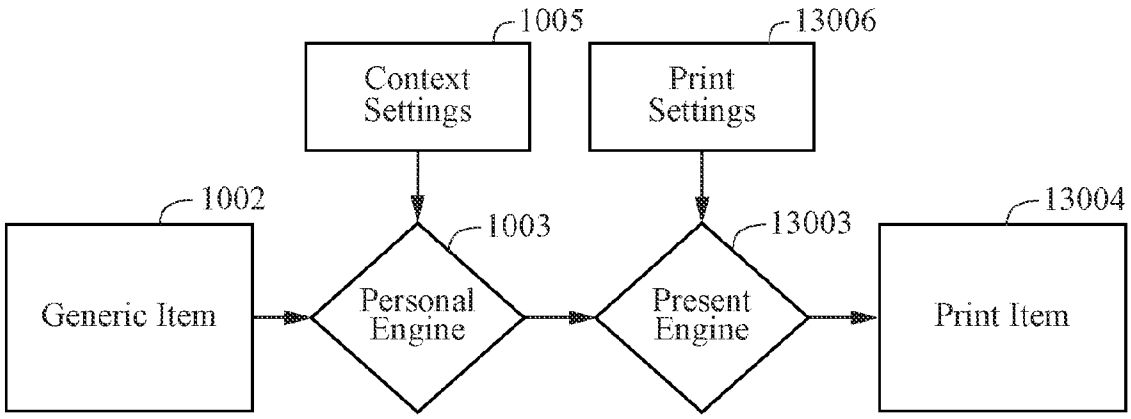
1005
Context Settings
13006
Print Settings
1002
Generic Item
1003
Personal Engine
13003
Present Engine
13004
Print Item

FIG. 13

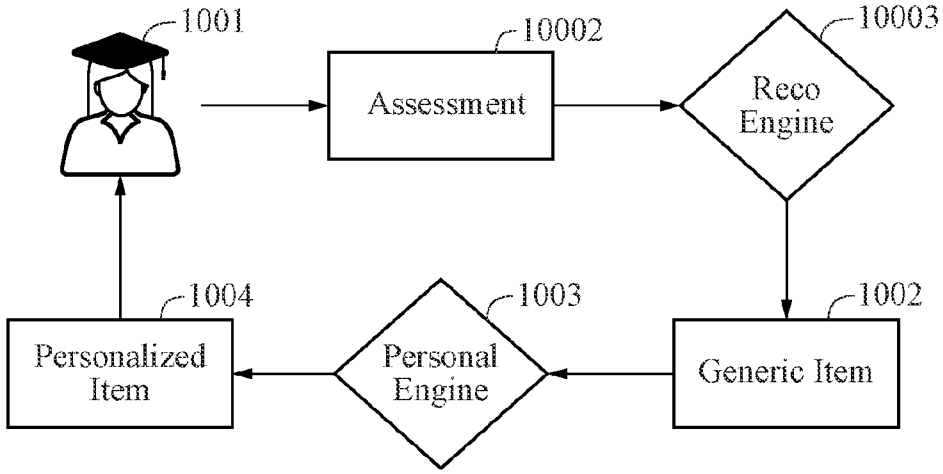
1001
10002
Assessment
10003
Reco Engine
1004
Personalized Item
1003
Personal Engine
1002
Generic Item

FIG. 14

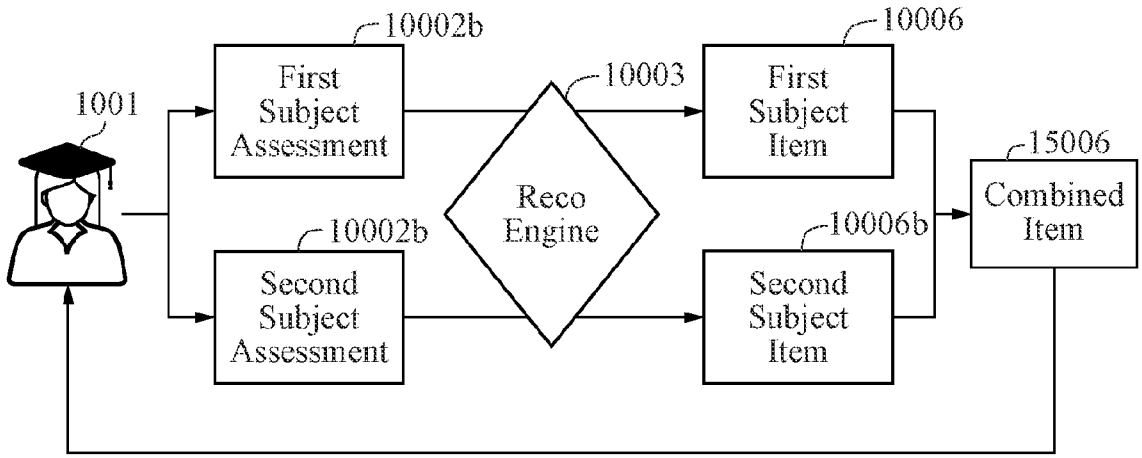
1001
10002b
First Subject Assessment
10002b
Second Subject Assessment
10003
Reco Engine
10006
First Subject Item
10006b
Second Subject Item
15006
Combined Item

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US22/47861

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. G06Q 50/20; G09B 7/00 (2023.01)
ADD. G09B 5/12 (2023.01)

CPC - INV. G06Q 50/20; G09B 7/00
ADD. G09B 5/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/0030923 A1 (CARROLL ET AL) 31 January 2013; Abstract; paragraphs [0037], [0043], [0052]-[0053], [0057]-[0060], [0136]	1-3, 9-11
X	US 2012/0141967 A1 (GERMAN ET AL) 07 June 2012; Abstract; paragraphs [0017], [0019], [0025]-[0026], [0029], [0037], [0042], [0066], [0071]-[0072], [0075]	1-2, 9-10
A	JP 2007057734 A (FUJI XEROX CO LTD) 08 March 2007; EMT Entire Document	1-3, 9-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 February 2023 (07.02.2023)	MAR 10 2023
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US22/47861

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
-***-Please See Supplemental Page-***-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-3, 9-11

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US22/47861

-***-Continued From Box No. III: Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-3, 9-11 are directed toward a computer-implemented method for generating a personalized educational item and a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a personalized educational item by: accessing a media item associated with the context selection.

Group II: Claims 4-5, 12-13 are directed toward a computer-implemented method for generating a personalized educational item and a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a personalized educational item by: receiving a plurality of social network connections for a user, each connection comprising at least a name.

Group III: Claims 6-8, 14-16 are directed toward a computer-implemented method for generating a combined educational item and a non transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a combined educational item by: assessing a user on a first subject; assessing a user on a second subject.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I include a computer-implemented method for generating a personalized educational item and a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a personalized educational item by: comprising: receiving a context selection from a plurality of possible context selections; accessing a media item associated with the context selection; combining the media item and the educational item to form a personalized educational item; and presenting the personalized educational item to the user, which are not present in Groups II-III.

Group II include a computer-implemented method for generating a personalized educational item and a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a personalized educational item by: receiving a plurality of social network connections for a user, each connection comprising at least a name; accessing an educational item; combining the educational item and at least one name of one social network connection of the plurality of social network connections to form a personalized educational item; and presenting the personalized educational item to the user, which are not present in Groups I and III.

Group III include a computer-implemented method for generating a combined educational item and a non transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a combined educational item by: assessing a user on a first subject; assessing a user on a second subject; selecting a first educational item related to the first subject according to the results of assessing the user on the first subject; selecting a second educational item related to the second subject according to the results of assessing the user on the second subject; combining the first educational item and the second educational item into a combined educational item; and presenting the combined educational item to the user, which are not present in Groups I-II.

The common technical features of Groups I-III are a computer-implemented method for generating a combined/personalized educational item and a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a combined/personalized educational item by: comprising: receiving a selection; accessing an educational item; combining the educational item and another item to form a combined/personalized educational item; and presenting the combined/personalized educational item to the user.

The common technical features of Groups I-III are disclosed by US 2015/0206452 A1 (FINANCIAL). Financial discloses a computer-implemented method for generating a combined/personalized educational item and a non-transitory computer-readable storage medium storing program instructions which cause a computer processor to generate a combined/personalized educational item by (a non-transitory computer-readable medium having instructions stored thereon that when executed by a processor of a computer cause the computer to perform steps to create the personalized education; abstract; paragraph [0014]): comprising: receiving a selection (individual takes a multiple choice questionnaire where they answer questions; paragraph [0014]); accessing an educational item (the topic of interest for the user is determined based on the answers; paragraph [0018]); combining the educational item and another item to form a combined/personalized educational item (the topic of interest may be finance, investing, financial planning, finance management, or combinations; paragraph [0024]); and presenting the combined/personalized educational item to the user (the topic of interest may be a combination which will provide a personalized financial education curriculum to the user in the form of educational materials; abstract; figure 3; paragraphs [0018], [0024]).

Since the common technical features are previously disclosed by the Financial reference, the common features are not special and so Groups I-III lack unity.