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ROTHWELL, FIGG, ERNST & MANBECK, P.C.
607 14th Street, N.W.
SUITE 800
WASHINGTON, DC 20005

EXAMINER
YIP, JACK

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte SYLVIA TIDWELL SCHEURING, RICHARD JAMES LEE, BRAD HANSON, and ROGER P. CREAMER

Appeal 2016-003546
Application 11/842,184[1]
Technology Center 3700

Before LINDA E. HORNER, MICHAEL L. HOELTER, and LYNNE H. BROWNE, *Administrative Patent Judges*.

HORNER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant seeks our review under 35 U.S.C. § 134(a) of the Examiner's decision rejecting claims 10, 14, and 21 under 35 U.S.C. § 101 as being directed to patent-ineligible subject matter. Final Office Action (December 19, 2014) (hereinafter "Final Act."). Appellant's counsel presented arguments at an oral hearing on February 27, 2018. We have jurisdiction under 35 U.S.C. § 6(b).

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[1] McGraw-Hill School Education Holdings LLC ("Appellant") is the applicant as provided for under 37 C.F.R. § 1.46, and is identified as the real party in interest. Appeal Brief 1 (May 19, 2015) (hereinafter "Appeal Br.").

Appellant's claimed subject matter relates to the field of education and provides a method for creating, assessing, and modifying a learning map. Specification ¶ 2 (filed August 21, 2007) (hereinafter "Spec."). A learning map is a device for expressing probabilistic dependency relationships between and amongst learning targets, misconceptions, and common errors associated with learning targets. *Id.* The system can use responses to assessments to evaluate the accuracy and usefulness of the learning map to find more optimal target definitions or relationship probabilities for all learners or subsets of learners, and modify the learning progress map network definition accordingly. *Id.* ¶ 13.

As explained below, because the claims as a whole are directed to an abstract idea and do not recite significantly more than the abstract idea, the claims are directed to patent-ineligible subject matter. Thus, we AFFIRM.

CLAIMED SUBJECT MATTER

Claims 10, 14, and 21 are independent. Claim 10 is illustrative of the subject matter on appeal and is reproduced below.

> 10. A computer-implemented student evaluation method, comprising the steps of:
>
> (a) administering a computer-implemented assessment to a student, wherein the computer-implemented assessment comprises a plurality of items;
>
> (b) using said computer to select a first learning target from a learning map;
>
> (c) using a computer to record or access the student's response to items in the computer-implemented assessment in a storage unit, wherein the items relate to said first learning target, precursors, or postcursors of said first learning target;
>
> (d) using said computer to determine, for the first learning target, a set of values, wherein the values are based on

> the student's responses to the items and predetermined response effect values;
>
> (e) using said computer to calculate a probability value that represents the probability that the student knows the first learning target, wherein the determined probability value is a function of, at the least, said set of determined values; and
>
> (f) using said computer to identify precursors and postcursors of the first learning target and to modify said learning map to store postcursor and precursor relationship data determined by said computer for said first learning target,
>
> further comprising the step of, for each postcursor, determining the probability that the student knows the postcursor,
>
> further comprising the step of determining whether the student's demonstrated knowledge state of the postcursors indicates that the student's actual probability of knowing the learning target is greater than the determined probability value, and
>
> further comprising the step of increasing the probability value if the student's demonstrated knowledge state of the postcursors indicates that the student's actual probability of knowing the learning target is greater than the determined probability value.

Appeal Br. 28–29 (Claims Appendix).

ISSUE

The Examiner determined that the claims do not recite patent eligible subject matter because the claim elements, considered both individually and in combination, do not amount to significantly more than an abstract idea. Final Act. 2. The Examiner stated that the claims are directed to the abstract idea of "a method of organizing human activities." *Id.* Specifically, the Examiner explained that the abstract idea comprises "administering a[n] assessment to a student, selecting a first learning target, recording/accessing

the student's response, determining a set of values, calculating a probability value, identifying precursors and postcursors, determining whether the student's demonstrated knowledge state of the postcursors, [and] increasing the probability value." *Id.* (emphasis omitted). In the Answer, the Examiner further explained that the claims recite "a formula of using a relationship map (an abstract idea of a learning map) of a plurality of learning items to calculate the probability of a student knowing a particular learning item." Ans. 2. The Examiner determined that this concept is similar to other types of basic concepts that courts have found to be abstract, such as a mathematical algorithm or a series of mental steps. *Id.*

The Examiner stated that the additional elements in the claim amount to no more than "recitation of generic computer structure that serves to perform generic computer functions that are well-understood, routine, and conventional activities" including "administering, selecting, record/access, calculating . . . increasing." Final Act. 2 (emphasis omitted); *see also* Ans. 3. The Examiner determined that these additional claim elements do not provide meaningful limitations to transform the abstract idea into a patent eligible application of the abstract idea. *Id.* The Examiner further found that the recited steps of displaying, recording, and accessing are insignificant pre-solution, data gathering activity. Ans. 3.

Appellant argues that the Office Action fails to provide:

> substantial evidence to support the underlying factual determinations with regard to: (1) the language of the claim if any that in some way implicates an idea that may arguably be abstract and (2) what makes the features and steps of the recited claims an abstract idea . . . and (3) showing that other claim elements alone or in combination are not sufficient to ensure

> that the claim amounts to significantly more than the abstract idea itself, e.g. that those other elements are conventional.

Appeal Br. 11. Appellant contends that because the Examiner found the claims to be patentable over the prior art, the claims are not directed to "merely routine or conventional subject matter." *Id.* at 12.

> Appellant asserts that the claimed invention is directed to:
>
> physically storing received responses in a storage unit and accessing that data at appropriate times in order to modify a learning map and probabilities in order to create a new, modified learning map and new probabilities in a new file to store postcursor and precursor relationship data determined by the prior steps.

Id. at 15. As such, Appellant contends that the claimed invention is directed to "a concept inextricably linked to computer technology." *Id.*; *see also* Reply Br. 11 (arguing the claims are "directed to a technical solution to a problem rooted in computer-implemented student evaluation systems with adaptive learning engines"). Appellant contests the Examiner's finding that the method could be carried out using "a human mind, a pen and paper." Reply Br. 12. Appellant also asserts that the claim is not directed to a mathematical algorithm. *Id.*

Appellant further argues that the claim is directed to significantly more than an abstract idea because it "addresses a technological challenge (dynamic student response evaluation and learning map modification) that is particular to student evaluation software." Appeal Br. 16–17. Appellant asserts that "the claimed solution is necessarily rooted in computer technology in order to overcome a problem specifically arising in the realm of student evaluation software." *Id.* at 17; *see also* Reply Br. 11 (asserting that the claims "address a problem arising in the realm of computerized

adaptive learning engines"). Appellant contends that that Examiner failed to produce evidence that the claimed method steps were "conventional or routine." *Id.* Appellant argues that the claims "go beyond the mere concept of simply retrieving and evaluating data using a computer" because the claims create and modify a learning map, store postcursor and precursor relationship data, and calculate and increase or decrease probability values. *Id.* at 22; *see also id.* at 26 (asserting that "the software itself is transformed"); Reply Br. 11 (arguing "the step of linking the plurality of received responses . . . with a stored learning map and precursor/postcursor relationships is specific to processing data from a computer-implemented student evaluation network"). "They are not simply claims to an abstract idea with the instruction to 'apply it[.]'" *Id.* at 25. "Here, the claims 'effect[] meaningful transformation' because they 'chang[e] the content' of the source data elements." *Id.*

In advance of the oral hearing, Appellant submitted a supplemental brief addressing intervening case law since the filing of the Reply Brief. Appellant's Notice of Supplemental Authority (February 15, 2018) (hereinafter "Supp. Br.").

The issue presented by this appeal is whether method claims 10, 14, and 21 are directed to a patent-ineligible abstract idea under the judicial exception to 35 U.S.C. § 101.

LEGAL PRINCIPLES

A patent may be obtained for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." 35 U.S.C. § 101. The Supreme Court has held that this provision contains an important implicit exception: Laws of nature, natural

phenomena, and abstract ideas are not patentable. *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2354 (2014); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) ("Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work."). Notwithstanding that a law of nature or an abstract idea, by itself, is not patentable, the application of these concepts may be deserving of patent protection. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 71 (2012). In *Mayo*, the Court stated that "to transform an unpatentable law of nature into a patent-eligible *application* of such a law, one must do more than simply state the law of nature while adding the words 'apply it.'" *Id.* at 72 (citation omitted).

In *Alice*, the Court reaffirmed the framework set forth previously in *Mayo* "for distinguishing patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts." *Alice*, 134 S. Ct. at 2355. The first step in the analysis is to "determine whether the claims at issue are directed to one of those patent-ineligible concepts." *Id.* If the claims are directed to a patent-ineligible concept, then the second step in the analysis is to consider the elements of the claims "individually and 'as an ordered combination"' to determine whether there are additional elements that "'transform the nature of the claim' into a patent-eligible application." *Alice*, 134 S. Ct. at 2355 (quoting *Mayo*, 566 U.S. at 79).

As to the first step, the Federal Circuit recently explained, in a case involving claims directed to computer animation software, that at step one "of the *Alice* test, in determining the patentability of a method, a court must

look to the claims as an ordered combination, without ignoring the requirements of the individual steps." *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1313 (Fed. Cir. 2016). The court in *McRO* determined that the computer animation claims were "limited to rules with specific characteristics" and that "[t]he specific, claimed features of these rules allow for the improvement realized by the invention." *Id.* In order to determine whether the claimed process raised a preemption concern, the court examined whether the claims "focus on a specific means or method that improves the relevant technology or are instead directed to a result or effect that itself is the abstract idea and merely invok[ing] generic processes and machinery." *Id.* at 1314. The court determined that the claims do not simply use a computer as a tool to automate conventional activity, finding no evidence that the process previously used by animators is the same as the process required by the claims. *Id.* Instead, the court found that "[t]he computer here is employed to perform a distinct process to automate a task previously performed by humans." *Id.* The court in *McRO* explained that "it [was] the incorporation of the claimed rules, not the use of the computer, that 'improved [the] existing technological process' by allowing the automation of further tasks." *Id.* at 1313 (alteration in original) (quoting *Alice*, 134 S. Ct. at 2358).

The court also determined that "the automation goes beyond merely organizing existing information into a new form or carrying out a fundamental economic practice." *Id.* at 1315 (citations and internal quotation marks omitted). Instead, the court found that "the claimed process uses a combined order of specific rules that renders information into a

specific format that is then used and applied to create desired results: a sequence of synchronized, animated characters." *Id.*

Thus, the court in *McRO* determined that the claimed genus of rules does not preempt all techniques for automating 3-D animation that rely on rules because the claim requires that the rules be rendered in a specific way. *Id.* at 1315. The court further noted the absence of a showing that any rules-based lip-synchronization process must use rules with the specifically claimed characteristics. *Id.* (stating that "the description of one set of rules does not mean that there exists only one set of rules."). Based on the specific features recited in the claims, the court held that the claimed process was not directed to an abstract idea and that it recites patent eligible subject matter under 35 U.S.C. § 101.

By contrast, in *FairWarning IP, LLC v. Iatric Systems, Inc.*, 839 F.3d 1089 (Fed. Cir. 2016), the Federal Circuit affirmed a district court determination that claims directed to "the concept of analyzing records of human activity to detect suspicious behavior" were not directed to patent eligible subject matter. *Id.* at 1093. The claims in *FairWarning* recited, generally, a method of detecting improper access of a patient's protected health information in a computer environment, comprising generating a rule for monitoring transactions/activity in an audit log, applying the rule to the audit log data, storing hits, and providing notifications of hits. *Id.* The Federal Circuit determined that the claims were directed to an abstract idea:

> We have explained that the "realm of abstract ideas" includes "collecting information, including when limited to particular content." *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1353 (Fed. Cir. 2016) (collecting cases). We have also "treated analyzing information by steps people go through in their minds, or by mathematical algorithms, without more, as

> essentially mental processes within the abstract-idea category." *Id.* And we have found that "merely presenting the results of abstract processes of collecting and analyzing information, without more (such as identifying a particular tool for presentation), is abstract as an ancillary part of such collection and analysis." *Id.* Here, the claims are directed to a combination of these abstract-idea categories. Specifically, the claims here are directed to collecting and analyzing information to detect misuse and notifying a user when misuse is detected. *See id.*

Id. at 1094–95; *see also Intellectual Ventures I LLC v. Capital One Financial Corp.*, 850 F.3d 1332, 1340 (Fed. Cir. 2017) (noting that the Federal Circuit has held on numerous occasions that an invention directed to collection, manipulation, and display of data was an abstract process).

The court in *FairWarning* distinguished the claims before it from the claims in *McRO*. 839 F.3d at 1094. The court in *McRO* explained that "it [was] the incorporation of the claimed rules, not the use of the computer, that 'improved [the] existing technological process' by allowing the automation of further tasks." *McRO*, 837 F.3d at 1314 (alteration in original) (quoting *Alice*, 134 S. Ct. at 2358). By contrast, "FairWarning's claims merely implement an old practice in a new environment" using "the same questions . . . that humans in analogous situations detecting fraud have asked for decades, if not centuries." *FairWarning*, 839 F.3d at 1094–95. "Although FairWarning's claims require the use of a computer, it is this incorporation of a computer, *not* the claimed rule, that purportedly 'improve[s] [the] existing technological process' by allowing the automation of further tasks." *Id.* at 1095 (quoting *Alice*, 134 S. Ct. at 2358).

The Federal Circuit more recently acknowledged that in cases involving software innovations, the inquiry as to whether the claims are

directed to an abstract idea "often turns on whether the claims focus on 'the specific asserted improvement in computer capabilities . . . or, instead, on a process that qualifies as an 'abstract idea' for which computers are invoked merely as a tool.'" *Finjan, Inc. v. Blue Coat Sys., Inc.*, 879 F.3d 1299, 1303 (Fed. Cir. 2018) (quoting *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1335–36 (Fed. Cir. 2016)). In *Finjan*, the court held that claims directed to a behavior-based virus scan constituted an improvement in computer functionality over the "traditional, 'code-matching' virus scans." *Id.* at 1304. Instead of looking for the presence of known viruses, "behavior-based" scans analyze a downloadable's code and determine whether it performs potentially dangerous or unwanted operations, thus, enabling more flexible and nuanced virus filtering. *Id.* The court determined that the claimed method employs a new kind of file and allows access to be tailored for different users, and allows the system to accumulate and use newly available, behavior-based information about potential threats. *Id.* at 1305. Based on these findings, the court determined that the claims are "directed to a non-abstract improvement in computer functionality, rather than the abstract idea of computer security writ large." *Id.* "Here, the claims recite more than a mere result. Instead, they recite specific steps—generating a security profile that identifies suspicious code and linking it to a downloadable—that accomplish the desired result." *Id.*

As stated above, the first step in *Alice* is to ascertain whether the claims are directed to a patent-ineligible concept. If the claims are directed to a patent-ineligible concept, then the second step in the *Alice* analysis is to consider the elements of the claims "individually and 'as an ordered combination"' to determine whether there are additional elements that

"'transform the nature of the claim' into a patent-eligible application." *Alice*, 134 S. Ct. at 2355 (quoting *Mayo*, 566 U.S. at 79). In other words, the second step is to "search for an 'inventive concept'—*i.e.*, an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.'" *Id.* (brackets in original) (quoting *Mayo*, 566 U.S. at 72–73). The prohibition against patenting an abstract idea "cannot be circumvented by attempting to limit the use of the formula to a particular technological environment or adding insignificant postsolution activity." *Bilski v. Kappos*, 561 U.S. 593, 610–11 (2010) (citation and internal quotation marks omitted). The Court in *Alice* noted that "'[s]imply appending conventional steps, specified at a high level of generality,' was not '*enough*' [in *Mayo*] to supply an 'inventive concept.'" *Alice*, 134 S. Ct. at 2357 (quoting *Mayo*, 566 U.S. at 82, 77, 72).

In *DDR Holdings*, the Federal Circuit held that claims "directed to systems and methods of generating a composite web page that combines certain visual elements of a 'host' website with content of a third-party merchant" contained the requisite inventive concept. *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1248 (Fed. Cir. 2014). The court explained that the claims at issue involved a technological solution that overcame a specific challenge unique to the Internet. *Id.* at 1259. In *Bascom Global Internet Servs., Inc. v. AT&T Mobility LLC*, 827 F.3d 1341, 1348 (Fed. Cir. 2016), the court similarly held that claims "directed to filtering content on the Internet" contained an inventive concept. The court found "an inventive . . . arrangement" of "known, conventional pieces" through "the installation of a filtering tool at a specific location, remote from

the end-users, with customizable filtering features specific to each end user." *Id.* at 1350. The claimed custom filter could be located remotely from the user because the invention exploited the ability of Internet service providers to associate a search request with a particular individual account. *Id.* This technical solution overcame defects in prior art embodiments and elevated an otherwise abstract idea to a patentable invention. *Id.*

By contrast, if the claim language "provides only a result-oriented solution, with insufficient detail for how a computer accomplishes it," then the claims do not contain an "inventive concept" under *Alice* step 2. *Intellectual Ventures I LLC v. Capital One Fin. Corp.*, 850 F.3d 1332, 1342 (Fed. Cir. 2017); *see also Elec. Power Grp.*, 830 F.3d at 1354 (explaining that claims are directed to an abstract idea where they do not recite "any particular assertedly inventive technology for performing [conventional] functions").

With these legal principles in mind, we now examine the claimed subject matter on appeal.

ANALYSIS

Step 1 of Alice

As the first step of our analysis, we determine whether claims 10, 14, and 21 are directed to a patent-ineligible concept, such as an abstract idea.[2] *See Alice*, 134 S. Ct. at 2355. In determining whether the claims are directed to an abstract idea, we must avoid oversimplifying the claims because "all

[2] Appellant argues claims 10, 14, and 21 as a group. Appeal Br. 10–26. We select claim 10 as a representative claim, and claims 14 and 21 stand or fall with claim 10. 37 C.F.R. § 41.37(c)(1)(iv). As such, our analysis focuses on the subject matter of claim 10.

inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas." *Mayo*, 566 U.S. at 71. To that end, we consider the claims "in light of the specification, based on whether 'their character as a whole is directed to excluded subject matter.'" *Enfish*, 822 F.3d at 1335–36 (quoting *Internet Patents Corp. v. Active Network, Inc.*, 790 F.3d 1343, 1346 (Fed. Cir. 2015)). In that regard, we determine whether the claims "focus on a specific means or method that improves the relevant technology" or are "directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery." *McRO, Inc.*, 837 F.3d at 1314.

Background

In the field of education, it is important to have an understanding of the dependency relationship between academic content areas and between concepts and skills within an academic content area for various groups of students. Spec. ¶ 3. For example, a dependency relationship exists between calculus and algebra, meaning that if a student does not have an understanding of algebra, there is a low probability that the student has an understanding of calculus. *Id.* ¶¶ 3–4. In another example, the dependency relationship could tell an educator that if a student understands multiplication, then there is a high probability that the student also understands addition. *Id.* ¶ 5.

The desired result of the claimed method is to "assess[] whether . . . hypothesized learning target dependencies are accurate." *Id.* ¶ 7. In particular, the method modifies hypothesized learning target dependencies expressed by a learning map "so that the learning map conforms to the reality of how students learn, or how different sub populations learn." *Id.*

¶ 8. The method begins with a learning map, comprising a network of targets connected by paths (i.e., relationships) with other learning targets and probabilities of path traversal, defined by a subject matter expert. *Id.* ¶¶ 9, 12. These inference values are based on the subject matter expert's expertise and experience in a particular field. *Id.* ¶ 65; *see also* Oral Hearing Transcript 6:17–18 (March 26, 2018) (hereinafter "Tr.") ("[W]hen you start this process, you come in with a learning map. This is created by a human."). "The adaptive system can utilize evaluations of the learning map by subject matter experts (SMEs) and/or by feedback from users to determine the accuracy of the learning map target definitions, relationship probabilities, and path probabilities." *Id.* ¶ 12. The method corrects errors in initial hypotheses about stages of learning in each content area and calibrates itself on an ongoing basis to changes in factors that can influence learning maps. *Id.* ¶ 15.

Claimed Subject Matter

Claim 10 is directed to a computer-implemented student evaluation method and recites six steps, labeled (a) through (f). In step (a), a computer-implemented assessment is administered to a student. The assessment comprises a plurality of items (e.g., questions). For example, Appellant's Specification describes that the assessment could include three items, where each item is a multiple choice question that has three possible responses (e.g., A, B, and C). Spec. ¶ 112. In step (b), the computer selects a first learning target from a learning map. The claim does not recite how the computer selects the learning target and does not associate the selection of this learning target with the assessment administered in step (a). In step (c), the computer either records or accesses the student's response to assessment

items in a storage unit. This claimed step specifically recites that the items recorded or accessed relate to the first learning target, precursors, or postcursors of the learning target. We understand these first three steps to encompass using the computer to administer a test to a student, where the test encompasses presenting questions directed to one or more learning targets, receiving and storing all of the student responses in a storage unit, selecting one specific learning target, and looking up from memory the stored student responses to those questions related to the selected learning target.

In step (d), the computer determines, for the selected learning target, a set of values. The claim recites that the values are based on the student's responses to the questions and predetermined response effect values. Appellant pointed to paragraph 117 of Appellant's Specification for a description of this step. Appeal Br. 3. The Specification describes that in this step, the computer determines a set of probability values based on the specific response that the student gave for each question using a response effect table the correlates each response to a probability that the student knows the learning target. Spec. ¶ 117. This response effect table is a table that associates a probability value or values with a learning target/item response pair. *Id.* ¶¶ 111, 116; Figs. 9, 13. The Specification does not describe how these probability values are derived. Because the Specification describes that initial values for other aspects of the learning map can be input by a subject matter expert (Spec. ¶ 43), we understand that the probabilities in this response effect table may come, at least initially, from a human being. So, step (d) of the claimed method involves the computer

using a look-up table to find a pre-assigned probability value based on the user's response to a particular question related to the selected learning target.

In step (e), the computer calculates a probability value that represents the probability that the student knows the first learning target, where the calculation is a function of the determined values from step (d). Appellant pointed to paragraph 118 of Appellant's Specification for a description of this step. Appeal Br. 3. The Specification describes that in this step, the calculation is "some mathematical function" such as calculation of an average of all the probability values determined in step (d), or selecting a maximum value from among the values determined in step (d). Spec. ¶ 118. Thus, step (e) of the claimed method involves the computer performing a mathematical operation using the values found in the look-up table in step (d).

In step (f), the computer identifies precursors and postcursors of the first learning target and modifies the learning map to store precursor and postcursor relationship data determined by the computer for the first learning target. Appellant identifies paragraphs 8, 105, 114 through 116, 119, 125, and 126 of Appellant's Specification as describing this step. Appeal Br. 3. Paragraph 8 describes generally the concept of a learning map and discloses that the method is able to assess whether information in the learning map is accurate and modify the learning map as necessary. This paragraph does not describe any specific examples of modifying the learning map. Paragraph 105 describes that one way to modify a learning map is to revise a precursor/postcursor pairing if a calculated inference value for the pair is less than a predetermined threshold. Paragraphs 114 through 116 appear to describe steps (b) and (c) of the claimed method and do not disclose

modifying the learning map. Likewise, paragraph 119 describes that steps (b) through (d) of the claimed method can be repeated for other learning targets. This paragraph does not disclose modifying the learning map. Paragraphs 125 and 126 describe using the system to create adaptive tests. Specifically, these paragraphs disclose using a student/learning target table to identify learning targets that need to be tested, using the learning map to skip a first learning target and test the student's knowledge of a second learning target, and using inference values in the learning map to infer that the student knows the first learning target based on the student's responses to questions relating to the second learning target. Spec. ¶¶ 125–126. Again, these paragraphs do not disclose modifying the learning map.

We located other portions of Appellant's Specification that discuss modifying the learning map. For instance, the Specification discloses, "[w]hen the system determines that a more optimal path exists, it modifies the learning progress map network definition accordingly." Spec. ¶ 13. Further, the Specification discloses:

> [i]f the source (or part of the source) of the inconsistency appears to be with the predictions provided by the structure of the learning map, then modifications to the structure of the learning map are postulated to bring the predictions of the learning map more closely in alignment with the evidence.

Id. ¶ 80. The Specification states, "[c]hanges to the structure include adding nodes, removing nodes, splitting nodes, combining nodes, adding arcs, removing arcs, changing the probability in the conditional probabilities for the arcs, etc." *Id.*

Construing this step (f) in light of the Specification, we understand this step to encompass the computer referring to the learning map to identify

the precursors and postcursors of the selected learning target and modifying the map with relationship data. The modification to the learning map encompasses changes to the structure of the map (i.e., changing nodes or arcs) and/or changes to the inference values (i.e., probability values) initially input by the subject matter expert. *See* Tr. 10:11–12:5 (Appellant's counsel acknowledging during oral hearing that the modification to the learning map could be simply updating an initial hypothesized inference value between two nodes on the learning map based on actual use of the learning map on a student evaluation).

The claim further recites, for each postcursor, (i) determining the probability that the student knows the postcursor, (ii) determining if the student's demonstrated knowledge state of the postcursors indicates that that the student's actual probability of knowing the learning target is greater than the determined probability value, and (iii) increasing the probability value if the student's demonstrated knowledge state of the postcursors indicates that the student's actual probability of knowing the learning target is greater than the determined probability value.[3] Appellant identifies paragraphs 43 and 120 through 124 of Appellant's Specification as describing these steps. Appeal Br. 3. Paragraph 43 describes that a subject matter expert can specify a postcursor inference value that represents the probability that a student knows the precursor learning target if it can be shown that the

[3] The Examiner stated that comparing actual probability to a calculated probability value, computing a modified probability value based on a student's demonstrated knowledge state, and calculating a probability that a student knows a precursor and/or a postcursor of a learning target based on the modified probability value were not practiced in the prior art. Notice of Allowance 2 (June 13, 2014).

student knows the postcursor learning target. This paragraph does not disclose increasing the initially hypothesized probability value.

Paragraphs 120 and 121 of the Specification disclose modifying an initial probability value for a given learning target based on an evaluation of the probability values assigned to the student for the given learning target's precursor and postcursor nodes. Spec. ¶¶ 120–121 (explaining that "[t]he closer the 'knows' value for the postcursors is to 1.0, the more likely it is that the student 'knows' the selected learning target"). Paragraphs 122 through 124 discuss additional features of the evaluation system to determine whether the student "knew but forgot" the selected learning target, the likelihood that the student guessed the correct response to an item, and the likelihood that the student misunderstood a given item. *Id.* ¶¶ 122–124.

We understand these claimed steps (i) through (iii), when read in light of the Specification, to encompass testing the initial probability values input by the subject matter expert based on actual test responses to determine whether the initial probability values are valid, and updating these values based on actual test responses. For instance, if the initial inference values indicate that a student has an 85% likelihood of knowing the selected learning target if the student answers questions correctly about the postcursor target, and actual test responses demonstrate that the student's actual probability of knowing the selected learning target is 90%, then the method updates this inference value to 90% in the learning map. In other words, these claim steps describe a feedback loop used to refine an initial hypothesized inference value using actual test results. This is one way to update the learning map. Because these additional steps are recited immediately following step (f) and these steps describe one way to modify

the learning map based on postcursor and precursor relationship data determined by the computer for the first learning target, we understand these additional steps to further limit step (f) by describing a modification to the inference value between the selected learning target and its postcursor as one means by which the computer modifies the learning map.

Abstract Idea

The Examiner generally characterized the abstract idea as "a method of organizing human activities" and specifically identified the parts of the claim falling within this categorization. Final Act. 2. In the Answer, the Examiner additionally characterized the abstract idea as a "formula of using a relationship map . . . to calculate the probability of a student knowing a particular learning item" and analogized this concept to mathematical algorithms or mental steps that the courts have found to be abstract ideas. Ans. 2.

Indeed, the claimed steps, when considered as an ordered combination, seek to patent the concept of testing hypothesized relationships between learning targets using actual test data, and refining these initial hypothesized values within a computer environment. We do not understand Appellant to assert that it was the first to recognize precursor and postcursor relationships between learning targets, or that it was the first to map these relationships. Prior to Appellant's application, teachers were aware of the concept of pre-cursor/post-cursor relationships existing between learning targets. For instance, a teacher knows that in order to teach students multiplication, the teacher must first instruct students in addition. Spec. ¶ 3. A teacher also knows that if a student does not know addition, the likelihood of the student knowing multiplication is low. *Id.* ¶¶ 5–6. A look at any list

of high school or college course offering proves that these relationships are known. The course offerings typically list prerequisite courses that a student must take prior to enrolling in another course. For instance, a student must study algebra as a prerequisite to enrolling in a calculus class. *Id.* ¶ 3. These prerequisite requirements are based on the concept that certain items of knowledge form the building blocks for later items. *See also* Tatsuoka (US 6,301,571 B1, issued October 9, 2001), col. 1, ll. 32–50, col. 4, ll. 12–21 (prior art cited by the Examiner in the Non-Final Action (dated April 24, 2013) (hereinafter "Non-Final Act.").

For example, Tatsuoka discloses using a partially ordered set ("poset"), which is a natural model for cognitive and functionality domains. *Id.* at col. 1, ll. 32–33. Tatsuoka explains that two states i and j in a poset model S may be related to each other such that "a test subject in state i can respond positively to all the test items to which a test subject in state j can, but a test subject in state j may not be able to respond positively to all the test items to which a test subject in state i can." *Id.* at col. 1, ll. 33–39. Tatsuoka explains that "a positive response on any item should provide at least as much evidence for the test subject being in state i as in state j." *Id.* at col. 1, ll. 40–42. Also, probability relationships between these related building blocks are known. *Id.* at col. 2, ll. 51–60 (describing class conditional density). Further, the idea of mapping these relationships is known. *See* Tatsuoka, col. 18, ll. 13–31, Figs. 4–10 (cited by the Examiner at Non-Final Act. 4 to show a learning map).

We also do not understand Appellant to assert that it was the first to use adaptive tests in a student evaluation environment. Appellant, in response to the Examiner's prior art rejection, acknowledged that the prior

art employed adaptive tests. Appellant's Amendment filed in response to the Non-Final Action 16 (dated November 6, 2013) (hereinafter "Resp.") (describing "Tatsuoka's method of making adaptive strategy tree decisions after each question" and stating that "Lewis acknowledges that adaptive tests were known").

Rather, Appellant points to the *modification* of the learning map by the computer as the key aspect of the claimed improvement to a computer-implemented student evaluation method. Tr. 7:1–13. As explained above, this modification amounts to updating hypothesized information on the learning map based on actual test data. The method of claim 10 is unlike the claimed invention in *McRO*, in which the animation software used *new rules* to automatically set a keyframe at the correct point to depict more realistic speech as compared to the prior art, in which animators had to subjectively identify a problematic sequence and fix it by adding an appropriate keyframe. *McRO*, 837 F.3d at 1307. Claim 10 does not recite rules that improve the student evaluation method by, for example, automating the creation of the learning map. *C.f.*, *McRO*, 837 F.3d at 1314 ("It is the incorporation of the claimed rules, not the use of the computer, that 'improved [the] existing technological process' by allowing the automation of further tasks") (quoting *Alice*, 134 S. Ct. at 2358). Rather, claim 10 is directed to collecting information and analyzing this information by steps people go through in their minds and by mathematical algorithms without more. *See FairWarning*, 839 F.3d at 1094–95.

Specifically, steps (a), (b), (c), and (d) amount to collection of data. These steps of administering an assessment, selecting a learning target, looking up responses to items related to the learning target, and looking up a

set of values based on the student's responses are within the "realm of abstract ideas" of a computer collecting data from external and internal sources. Step (e), which is directed to calculating a probability value, amounts to a mathematical algorithm — another category of abstract ideas. Finally, step (f) is directed to the abstract idea of using actual data as feedback to modify a hypothesis. In the field of student evaluation methods, the prior art method hypothesized relationships between learning targets, mapped these relationships, and assigned probabilities to these relationships. The claimed improvement to this method is to simply use a feedback loop during implementation of the student evaluation method to refine and update the hypothesis using actual data.

Such a step without more is abstract as an ancillary part of such collection and analysis. *Id.* Similar to the claims in *FairWarning*, it is the incorporation of a computer to modify the learning map based on actual responses received from the student that purportedly "'improve[s] [the] existing technological process' by allowing the automation of further tasks." *FairWarning*, 839 F.3d at 1095 (quoting *Alice*, 134 S. Ct. at 2358). In other words, we agree with the Examiner that claim 10 is directed to implementing an old practice of student evaluation testing methods based on dependency relationships between learning targets in computer environment, using the same hypotheses that humans in student evaluation testing have used prior to Appellant's invention.

Just like in *Flook*[4] and *Bilski*, limiting the abstract idea to the field of an adaptive learning engine does not make the concept patent eligible. The

[4] *Parker v. Flook*, 437 U.S. 584 (1978).

claims attempt to patent the use of the abstract idea of learning target dependency relationships in an adaptive learning engine environment. *See* Tr. 7:1–9. In other words, the claims are directed to using a learning map devised by subject matter experts to assess a student and then revising the learning map based on actual responses received from the student. The revision could be simply updating an initial hypothesized inference value between two nodes on the learning map based on actual use of the learning map on a student evaluation. *Id.* at 10:11–12:5.

Unlike in *Finjan* or *Enfish*, appealed claim 10 does not recite an improvement in computer capabilities. *Finjan*, 879 F.3d at 1303; *Enfish*, 822 F.3d at 1335–36. Rather, the improvement is to the underlying assumptions in the learning map (an abstract idea), and the computer is invoked merely as a tool to test and update these assumptions. The use of the computer to modify the learning map using particularly claimed rules did not improve an existing technological process; instead, these rules merely use the computer a tool to automate conventional activity. *See McRO*, 837 F.3d at 1314. For these reasons, we agree with the Examiner that claim 10 is directed to an abstract idea.

Step 2 of Alice

Claim 10 does not add significantly more to the abstract idea. Appellant contends that, as in *DDR Holdings*, the appealed claims here address "a technological challenge (dynamic student response evaluation and learning map modification) that is particular to student evaluation software." Appeal Br. 16–17. Appellant asserts that "the claimed solution is necessarily rooted in computer technology in order to overcome a problem

specifically arising in the realm of student evaluation software." *Id.* at 17. We disagree with Appellant's characterization of the claimed invention.

Appellant's claim is directed to a method of testing and refining assumptions made by a subject matter expert in a learning map. Spec. ¶ 7 ("What is desired, therefore, is a system and method for expressing hypothesized learning target dependencies and for assessing whether the hypothesized learning target dependencies are accurate."). This "problem" of testing hypothesized learning target dependencies and probabilities for accuracy is not rooted in computer technology; rather, it is a problem faced by educators generally in the field of education. Spec. ¶ 3. Unlike *DDR Holdings*, claim 10 does not involve a technological solution. *See DDR Holdings*, 773 F.3d at 1259. Rather, the solution to the problem identified by Appellant is to simply examine the actual student responses and test data to verify the accuracy of the hypothesized relationships and probability values. The computer is simply the tool used to perform the testing and modification.

The computer used is a generic processor performing conventional functions of data gathering, comparing, analyzing, and updating. *See* Spec. ¶¶ 145–151; Fig. 15 (describing a conventional example computer system 1501, including a processor 1504 connected to a bus 1502, a memory 1506, a secondary memory 1508, and a communications interface 1524). Thus, claim 10 does not recite "any particular assertedly inventive technology for performing [conventional] functions." *Elec. Power Grp.*, 830 F.3d at 1354.

Appellant contends that similar to the claims held to be patent eligible in *Diamond v. Diehr*, 450 U.S. 175 (1981), the method of claim 10 improves pre-existing technology. Appeal Br. 22. Appellant states that the recited

steps "allow[] dynamic modification of learning maps and storage of postcursor and precursor relationship data, as well as modification of probability values to improve the student evaluation software both for the student being evaluated as well as other students that will be evaluated using the software thereafter." *Id.* at 23. Claim 10 recites modifying a hypothesized learning map (e.g., a hypothesized inference value) through analysis of actual gathered data representing an actual inference value, which is a fundamental concept of a system using feedback to refine an initial value. This is the basis for the scientific method.[5] Thus, claim 10 does not present a new technical solution, and we perceive no "inventive concept" that transforms the abstract idea of collecting, analyzing, and updating data into a patent-eligible application of that abstract idea.

Further, we are not convinced that the steps transform the abstract concept into a patentable invention simply because the Examiner determined that the last three steps of claim 10 were not practiced in the prior art. Notice of Allowance 2 (June 13, 2014). "Eligibility and novelty are separate inquiries." *Two-Way Media Ltd. v. Comcast Cable Comm'ns, LLC*, 874 F.3d 1329, 1339–40 (Fed. Cir. 2017); *see also Affinity Labs of Texas, LLC v.*

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[5] The Oxford English Dictionary on-line defines the scientific method as "A method of observation or procedure based on scientific ideas or methods; *spec.* an empirical method that has underlain the development of natural science since the 17th cent." OED on-line dictionary, available at http://www.oed.com/view/Entry/383323 (last accessed on April 19, 2018). The definition describes that "[t]he scientific method is now commonly represented as ideally comprising some or all of (a) systematic observation, measurement, and experimentation, (b) induction and the formulation of hypotheses, (c) the making of deductions from the hypotheses, (d) the experimental testing of the deductions, and (if necessary) (e) the modification of the hypotheses." *Id.*

DIRECTV, LLC, 838 F.3d 1253, 1263 (Fed. Cir. 2016) (holding that "[e]ven assuming" that a particular claimed feature was novel does not "avoid the problem of abstractness."). Even if claim 10 recites an unconventional ordered combination of steps for testing the accuracy of the hypothesized probability value of the learning target, the fact that those steps have not previously been employed in the art is not sufficient, standing alone, to confer patent eligibility upon claim 10 because the claimed steps improve the abstract idea of using adaptive learning to test the accuracy of a hypothesized learning map, and do not improve the computer's performance. *See Versata Develop. Grp., Inc. v. SAP Am., Inc.*, 793 F.3d 1306, 1335 (Fed. Cir. 2015) (claims improved abstract idea not a computer's performance).

For these reasons, we sustain the rejection of claim 10, and claims 14 and 21 which fall with claim 10, under 35 U.S.C. § 101.

DECISION

The decision of the Examiner rejecting claims 10, 14, and 21 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED