

Baseball as a Metaphor for Teaching PHP



After attending to this presentation, it is my intention that you:

- **Will *integrate* your understanding of Human Cognitive Architecture in lesson planning.**
- **Can *describe* in both lay and technical terms the fundamental process of connecting to and interacting with a MySQL database using PHP.**
- **Can effectively *debug* a faulty PHP/MySQL database connection**
- **AND *teach* others to do the same.**

Origins and Expectations

Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching



Paul A. Kirschner

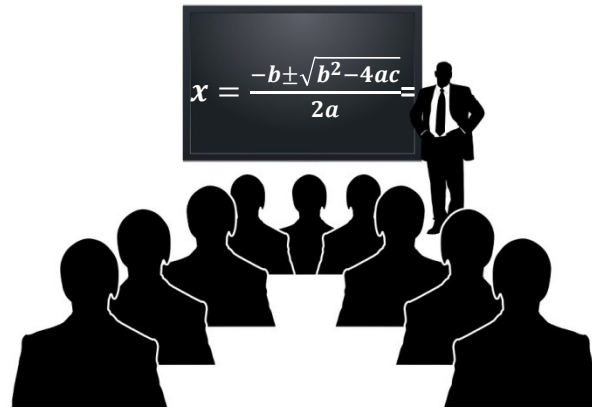
*Educational Technology Expertise Center
Open University of the Netherlands
Research Centre Learning in Interaction
Utrecht University, The Netherlands*

John Sweller

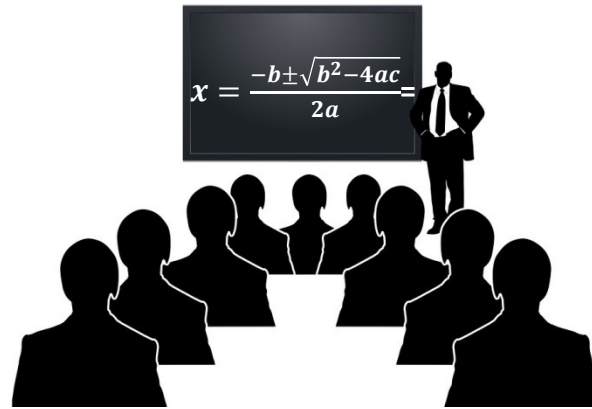
*School of Education
University of New South Wales*

Richard E. Clark

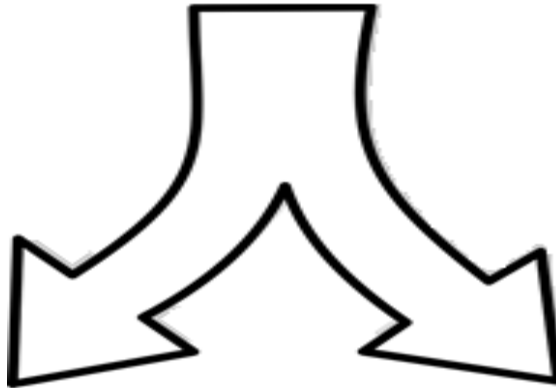
*Rossier School of Education
University of Southern California*

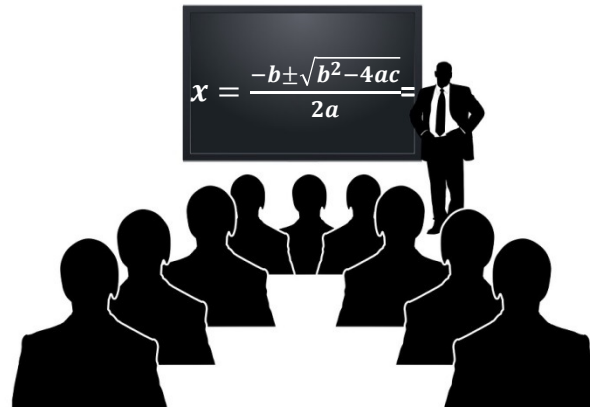


Shown two worked-out problems

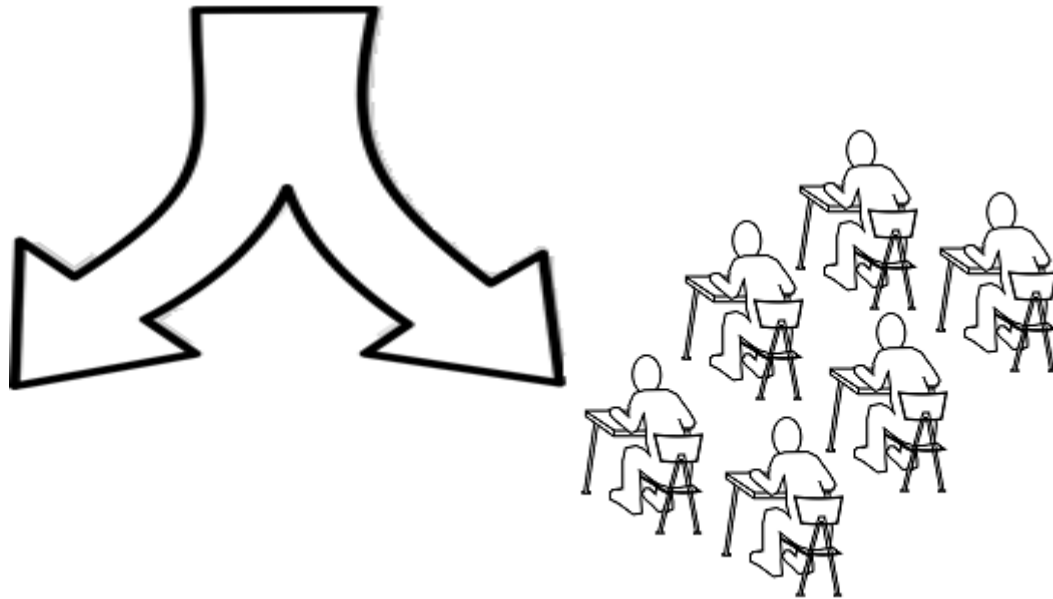


Shown two worked-out problems

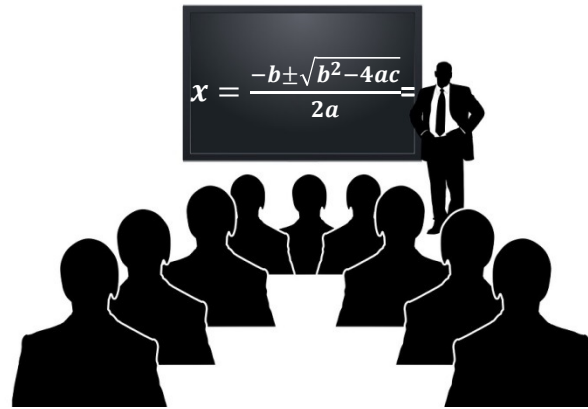




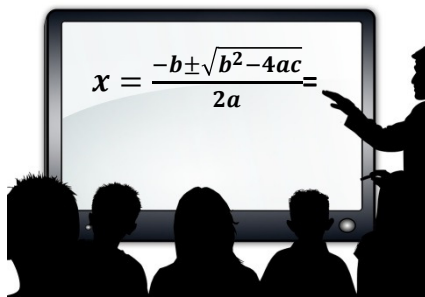
Shown two worked-out problems



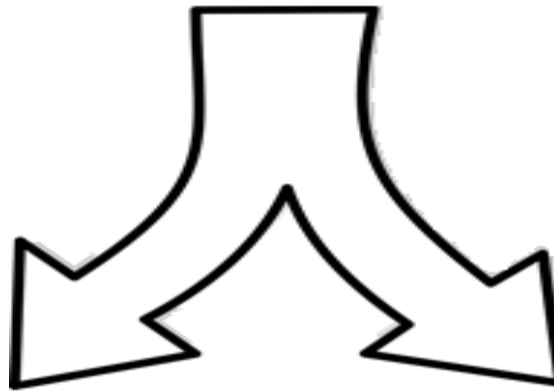
Control group: Solves eight additional new problems.



Shown two worked-out problems



Experimental group: *Shown*
eight more worked-out problems.



Control group: *Solves* eight
additional new problems.

Both groups given new problems to solve

Experimental

(shown the solutions)



Control

(Work out solutions)



Both groups given new problems to solve

Experimental

(shown the solutions)



Control

(Work out solutions)



**Which group
performed better?**

Both groups given new problems to solve

Experimental

(shown the solutions)



Control

(Work out solutions)



- Solved in half the time

Both groups given new problems to solve

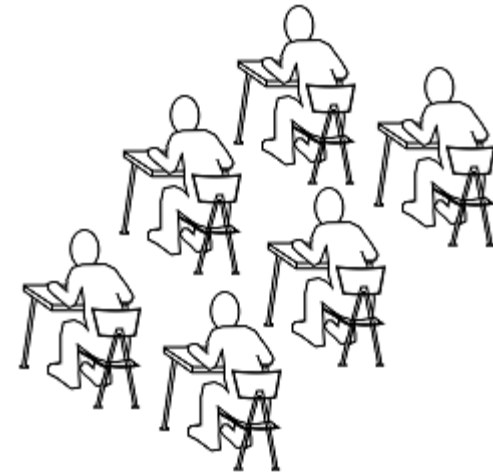
Experimental

(shown the solutions)



Control

(Work out solutions)



- Solved in half the time
- With fewer errors

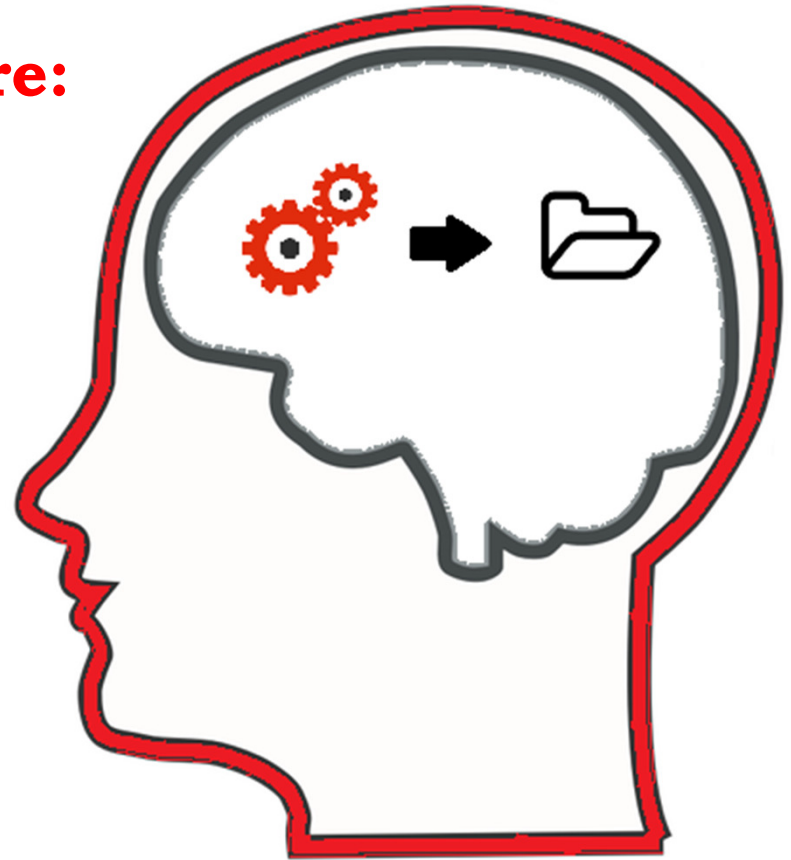
Why?

Human Cognitive Architecture:

Working Memory

Long-term Memory

Cognitive Load



Metaphor reduces cognitive load

Why Baseball is a good metaphor for teaching PHP:

- It is **familiar**. Uses minimal cognitive load (Pulls from long-term memory)
- The stations of the metaphor mirror in **name and in action** essential steps in the process of database connection and access.
- Provides a **structure to hang** new learning on.
- Provides a **vocabulary** (*i.e. a lexical reference*) to use in discussions and in de-bugging.

The Metaphor



Client (Browser)



Client (Browser)



Server



Client (Browser)



Server



Database



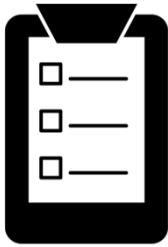


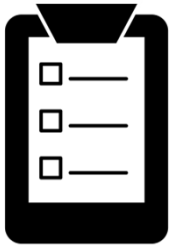
1

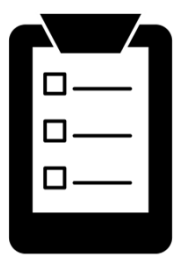
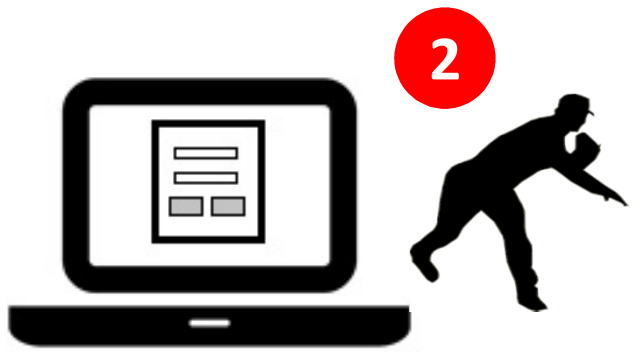


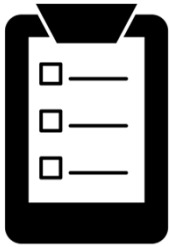


1















Register (roster) your players. (Authorize to play)

```
<?php
$host = 'pav-dbs-0103';
$database = 'petry0Z1';
$username = 'petry0Z1';
$password = 'notGonnaTell';
?>
```

config.php

```
<?php
require('config.php');
$conn = mysql_connect("$dbhost", "$dbuser", "$dbpassword");
if (!$conn) {
    echo "Unable to connect to DB: " . mysql_error();
    exit;
}
if (!mysql_select_db("$dbdatabase", $conn)) {
    echo "Unable to select database: " . mysql_error();
    exit;
}
?>
```

db.php



Collect, then throw the data (Via a web form)

```
<!doctype html>
<html>
<head><meta charset="utf-8">
<title>Sign In</title>
</head>
<body>
  <form name='search' action='searchbikes.php' method='get'>
    <h2>Select a Bicycle</h2>
    <label for="brand">Brand</label>
    <input type="text" name="brand" >
    <label for="price" >Price</label>
    <input type="text" name="price">
    <input type="submit" name="submit" value='FIND'>
  </form>
</body></html>
```

Select a Bicycle

Brand

Price

FIND

Catch it on the server.



```
<?php
require_once ("db.php");

$brand = $_GET['brand'];
$price = (int)$_GET['price'];
```

Hit the database.



```
$bikeSql = "Select * from bicycles where brand =  
'$brand' and price <= $price";  
  
$searchRes = mysql_query($bikeSql);
```



Run through the data.

```
if($searchRes){
  echo $brand . " bikes for $" . $price . ` or less:<br/>'
  while($bikeRow = mysql_fetch_assoc($searchRes)){
    echo $ bikeRow['model'] . `(` . bikeRow['price'] . `)<br/>';
  }
}
?>
```


De-bugging





*Connecting: Strategic echos.

```
<?php
$host = 'pav-dbs-0103';
$database = 'petry0Z1';
$username = 'petry0Z1';
$password = 'notGonnaTell';
echo "Made it through config!";
?>
```

config.php

```
<?php
require('config.php');
$conn = mysql_connect("$dbhost", "$dbuser", "$dbpassword");
if (!$conn) {
    echo "Unable to connect to DB: " . mysql_error();
    exit;
}
if (!mysql_select_db("$dbdatabase", $conn)) {
    echo "Unable to select database: " . mysql_error();
    exit;
}

echo "Connection successful!";
?>
```

db.php



* Throwing: Check the URL



Select a Bicycle

Brand

Price

FIND

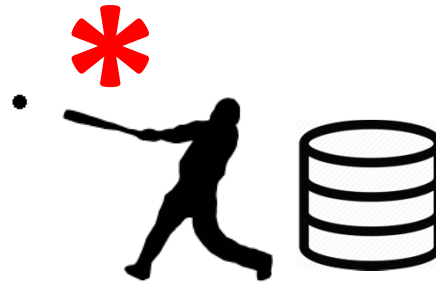
<http://.../bike/searchbikes.php?brand=TREK&price=1500>



* Catching: Print what you catch!

```
<?php  
  
require_once("db.php");  
  
$brand = $_GET['brand'];  
$price = (int)$_GET['price'];  
  
$echo $brand . '<br/>';  
$echo $price+1;  
  
?>
```





* Hit: Print your SQL. Then play it.



```
$bikeSql = "Select * from bicycles where  
brand = '$brand' and price <= $price";  
echo bikeSql;
```

A screenshot of a MySQL terminal window. The window has a title bar with minimize, maximize, and close buttons. The terminal text is as follows:

```
mysql> select * from postal where state = NY;  
ERROR 1054 (42S22): Unknown column 'NY' in 'where clause'  
  
mysql> select * from postal where state = 'NY';  
+-----+-----+-----+  
| postCode | city      | state |  
+-----+-----+-----+  
|    10005 | New York | NY    |  
+-----+-----+-----+  
1 row in set (0.00 sec)  
  
mysql>
```





* Running: echos and num_rows.

```
if($searchRes){
    echo mysql_num_rows($searchRes);
    echo $brand . " bikes for $" . $price . ` or less:<br/>`
    while($bikeRow = mysql_fetch_assoc($searchRes)){
        echo $ bikeRow['model'] . `(` . bikeRow['price'] . `)<br/>`;
    }
}else{
    echo `No results`;
}
```

10 De-bugging Strategies

1. **The Echo Statement**
2. **Single Line or Block Commenting**
3. **`print_r()`**
4. **`var_dump()`**
5. **Breakpoints**
6. **Stepping over**
7. **`ini_set('display_errors', 'On');`**
8. **`error_reporting(E_ALL | E_STRICT);`**
9. **FirePHP**
10. **Logging**

Bonus Material

mysql_query

(PHP 4, PHP 5)

mysql_query — Send a MySQL query

Warning This extension was deprecated in PHP 5.5.0, and it was removed in PHP 7.0.0. Instead, the [MySQLi](#) or [PDO_MySQL](#) extension should be used. See also [MySQL: choosing an API](#) guide and [related FAQ](#) for more information. Alternatives to this function include:

- [mysqli_query\(\)](#)
- [PDO::query\(\)](#)

MySQLi Database Access: Procedural

roster

```
$con = mysqli_connect("localhost","user","password","db");
```

catch

```
$brand = $_POST['brand'];  
$price = $_POST['price'];
```

hit

```
$sql="SELECT Lastname, Age FROM Persons ORDER BY Lastname";  
$result = mysqli_query($con, $sql);
```

```
while($row = mysqli_fetch_assoc($result))  
{  
    printf ("%s (%s)\n", $row["Lastname"], $row["Age"]);  
}
```

run

```
foreach($results as $row) {  
    echo $row['model'] . ' ($' . $row['price'] . ')<br/>';  
}
```

MySQLi Database Access: Objects

roster

```
if($db->connect_errno > 0){  
    die('Unable to connect to database:' . $db->connect_error; }
```

catch

```
$brand = $_POST['brand'];  
$price = $_POST['price'];
```

hit

```
$sql="SELECT Lastname, Age FROM Persons ORDER BY Lastname";  
if(!$result = $db->query($sql)){  
    die('There was an error running the query:" . $db->error;  
    }  
}
```

run

```
while($row = $result->fetch_assoc()){  
    echo $row['username'] . '<br />';  
}
```


PHP Class Def Example

```
<?php class person {
    var $lname, $fname;
    public $height;
    protected $studentnumber;
    private $phonenumber;

    function __construct($lastname, $firstname) {
        $this->lname = $lastname;
        $this->fname = $firstname;    }
    function set_name($newlast, $newfirst) {
        $this->lname = $newlast;
        $this->fname = $newfirst;    }
    function get_name() {
        return $this->lname . ', ' . $this->fname;
    }
    private function get_phonenumber() {
        return $this->phonenumber;
    }
}

$bill = new person("Petry", "Bill");
print $bill->get_name() . '<br/>';
echo $bill->lname;
?>
```

PHP Data Objects (PDO)

roster

```
$db = new PDO('mysql:host=localhost;dbname=testdb;charset=utf8mb4',  
'username', 'password');
```

catch

```
$brand = $_POST['brand'];  
$price = $_POST['price'];
```

hit

```
$stmt = $db->prepare("SELECT * FROM bicycles WHERE brand=? AND  
price <= ?");  
$stmt->execute(array($brand, $price));  
$results = $stmt->fetchAll(PDO::FETCH_ASSOC);
```

run

```
foreach($results as $row) {  
    echo $row['model'] . ' ($' . $row['price'] . ')<br/>';  
}
```

```
when Button1 .Click
do
  set Web1 . Url to join " http://www.mrpetry.net/web/do.php"
                        "?user=50072926"
  call Web1 .Get
```

```
when Web1 .GotText
  url responseCode responseType responseContent
do
  if
    get responseCode = 200
  then
    set lblRetVal . Text to get responseContent
  else
    call Notifier1 .ShowAlert
      notice " Trouble connecting"
```



```
1  <?php
2      require_once("db.php");
3      $_GET['user'];
4      $theID = $studentSQL = "SELECT * FROM students
5          WHERE studentNumber = $theID ";
6      $studentRes = mysql_query($studentSQL);
7      if($studentRes) {
8          while($stuRow=mysql_fetch_assoc($studentRes)) {
9              echo $stuRow['lastname'] .
10                 $stuRow['firstname'] ;
11          }
12      }else{
13          exit("No students");
14      }
15  ?>
```

References

<http://www.mrpetry.net>

Kirschner, P.A., Sweller, J., and Clark, R.E. (2006)

Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching.

Educational Psychologist 41 (2) 75-86.

<http://bit.ly/1BAsEoH>

Guzdial, Mark

What's the Best Way to Teach Computer Science to Beginners?

Communications of the ACM, February, 2015 Vol.58, No.2, 12-13

<http://cacm.acm.org/blogs/blog-cacm>

State the goals/objectives

Use PowerPoint as a *visual* medium.

Integrate cooperative learning

Reduce cognitive load: Use metaphor

Tell stories

Use humor