**Astraal LXP – Learning Engagement Scoring Engine**

***(Standalone, Journey-Aligned, Measurement-Only Module)***

**1. Correct Framing (Very Important)**

**What this module is**

A transparent, learner-visible **engagement measurement layer** that reflects *how* a learner is interacting with the learning journey — not *how well* they are performing.

**What this module is NOT**

* ❌ Not adaptive learning
* ❌ Not recommendation logic
* ❌ Not performance evaluation
* ❌ Not behavioural profiling

**Engagement ≠ Intelligence ≠ Judgement**

This distinction protects trust.

**2. Problem Statement (Formal)**

**Problem**

E-learning platforms often confuse engagement with performance or completion. Learners and faculty lack a **clear, fair, and explainable view of engagement** across learning activities such as exploration, practice, collaboration, reflection, and continuity.

This leads to:

* Misinterpretation of learner behaviour
* Over-reliance on assessments
* Faculty blind spots
* Learner anxiety around “being tracked”

**Solution**

Design a **standalone Learning Engagement Scoring Engine** that:

* Measures engagement across **journey activities**, not outcomes
* Uses **simple, explainable signals**
* Separates engagement from performance
* Is visible to learners and faculty
* Never drives automated decisions

**3. Engagement Model (Journey-Aligned)**

Based on your Astraal LXP learner journey, engagement is observed across **five neutral dimensions**:

| **Dimension** | **Meaning** |
| --- | --- |
| Presence | Is the learner showing up? |
| Continuity | Is engagement consistent over time? |
| Interaction | Is the learner interacting with content/tools? |
| Participation | Is the learner engaging with people/projects? |
| Reflection | Is the learner pausing, revisiting, thinking? |

⚠️ No “effort”, no “attitude”, no “motivation” labels.

**4. High-Level System Architecture (Standalone)**

Learner Actions (Astraal LXP UI)

↓

Engagement Event Logger (PHP)

↓

Engagement Events Store (MySQL)

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Engagement Scoring Engine (Python – batch/trigger)

↓

Engagement Scores Store (MySQL)

↓

Learner & Faculty Views (Read-Only)

**Key Architectural Boundaries**

* No real-time processing
* No long-running Python services
* No dependency on adaptive engines
* PHP controls orchestration

**5. Database Design (Minimal & Safe)**

**5.1 Engagement Events (Raw, Neutral)**

CREATE TABLE engagement\_events (

event\_id INT AUTO\_INCREMENT PRIMARY KEY,

learner\_id INT,

journey\_area VARCHAR(50),

event\_type VARCHAR(50),

event\_weight FLOAT,

created\_on DATETIME DEFAULT CURRENT\_TIMESTAMP

);

**Examples**

* journey\_area: Learning Path, Coding Ground, Collaborative Learning
* event\_type: viewed, attempted, participated, revisited

**5.2 Engagement Scores (Computed)**

CREATE TABLE engagement\_scores (

learner\_id INT,

presence\_score FLOAT,

continuity\_score FLOAT,

interaction\_score FLOAT,

participation\_score FLOAT,

reflection\_score FLOAT,

overall\_engagement FLOAT,

calculated\_on DATETIME

);

⚠️ Scores are **descriptive**, not evaluative.

**6. PHP Build Guide**

**6.1 Engagement Event Logging (Core Hook)**

**/api/log\_engagement.php**

<?php

include("../config/db.php");

$learner\_id = $\_SESSION['learner\_id'];

$journey\_area = $\_POST['journey\_area'];

$event\_type = $\_POST['event\_type'];

$weights = [

"viewed" => 1,

"attempted" => 2,

"participated" => 3,

"revisited" => 2

];

$weight = $weights[$event\_type] ?? 1;

$conn->query("

INSERT INTO engagement\_events

(learner\_id, journey\_area, event\_type, event\_weight)

VALUES ($learner\_id,'$journey\_area','$event\_type',$weight)

");

?>

This can be triggered:

* On page load
* On button clicks
* On activity completion  
  *(sparingly, not everywhere)*

**6.2 Trigger Engagement Scoring (Manual / Scheduled)**

**/api/trigger\_engagement\_score.php**

<?php

$learner\_id = $\_SESSION['learner\_id'];

exec("python3 /home/user/python/engagement\_engine.py $learner\_id");

?>

Or via nightly cron for all learners.

**7. Python Engagement Scoring Engine**

**7.1 Scoring Philosophy**

* Normalize by time window
* No penalties
* No comparisons between learners
* Each dimension scored independently

**7.2 Engagement Engine**

**engagement\_engine.py**

import sys

import mysql.connector

learner\_id = sys.argv[1]

db = mysql.connector.connect(

host="localhost",

user="db\_user",

password="db\_pass",

database="astraal\_lxp"

)

cursor = db.cursor(dictionary=True)

cursor.execute("""

SELECT journey\_area, SUM(event\_weight) as score

FROM engagement\_events

WHERE learner\_id=%s

AND created\_on >= NOW() - INTERVAL 14 DAY

GROUP BY journey\_area

""", (learner\_id,))

rows = cursor.fetchall()

# Simple mapping

presence = len(rows)

interaction = sum(r['score'] for r in rows)

participation = sum(r['score'] for r in rows if r['journey\_area'] == 'Collaborative Learning')

reflection = sum(r['score'] for r in rows if r['journey\_area'] in ('Revisit','Reflection'))

continuity = min(presence / 5, 1.0)

overall = round((presence + interaction + participation + reflection) / 10, 2)

cursor.execute("DELETE FROM engagement\_scores WHERE learner\_id=%s", (learner\_id,))

cursor.execute("""

INSERT INTO engagement\_scores

VALUES (%s,%s,%s,%s,%s,%s,%s,NOW())

""", (

learner\_id,

presence,

continuity,

interaction,

participation,

reflection,

overall

))

db.commit()

This is **intentionally simple and explainable**.

**8. Learner Engagement View (UX Principles)**

**Learner Copy (Exact, Recommended)**

**Your Engagement Snapshot**  
This reflects how you’ve been interacting with learning activities recently.  
It does not measure performance, grades, or ability.

Show as:

* Bars or dots
* No red/green
* No ranks
* No comparisons

Example labels:

* *High / Steady / Light* (not good/bad)

**9. Faculty Engagement View (Observation-Only)**

**Faculty Can See**

* Engagement by journey area
* Trends over time
* Sudden drops or spikes

**Faculty Cannot See**

* Behavioural labels
* “Risk” scores
* Predictions

**Faculty Copy**

Engagement reflects participation patterns, not effort or competence.  
Use this view to support learners, not evaluate them.

**10. Governance Rules (Document These)**

You should **explicitly document**:

* Engagement scores are descriptive
* Scores are time-bounded
* Learners can view their own data
* No automated actions triggered
* Faculty interpretation is contextual

This makes the module institution-safe.

**11. Why This Is a Flagship-Grade Module**

This engine:

* Separates **engagement from performance** (rare)
* Preserves learner dignity
* Gives faculty visibility without bias
* Prepares clean inputs for future systems
* Aligns perfectly with Edu 5.0 values

Most platforms get this wrong.

**1️⃣ Week-Over-Week Engagement Trend Analysis**

**Objective**

Help learners and faculty see **movement over time**, not static scores.

Trend ≠ comparison  
Trend ≠ performance  
Trend = pattern visibility

**1.1 Database Enhancement**

Add a weekly snapshot table.

CREATE TABLE engagement\_weekly\_trends (

learner\_id INT,

week\_start DATE,

presence\_score FLOAT,

interaction\_score FLOAT,

participation\_score FLOAT,

reflection\_score FLOAT,

overall\_engagement FLOAT,

recorded\_on DATETIME

);

**1.2 Python Weekly Aggregation Logic**

Modify engagement\_engine.py to compute:

cursor.execute("""

SELECT

YEARWEEK(created\_on, 1) as yw,

COUNT(\*) as total\_events,

SUM(event\_weight) as total\_weight

FROM engagement\_events

WHERE learner\_id=%s

GROUP BY yw

ORDER BY yw DESC

LIMIT 4

""", (learner\_id,))

For each week:

* Normalize engagement (0–1 scale)
* Store into engagement\_weekly\_trends

Example simplified insertion:

cursor.execute("""

INSERT INTO engagement\_weekly\_trends

VALUES (%s,%s,%s,%s,%s,%s,%s,NOW())

""", (

learner\_id,

week\_start,

presence,

interaction,

participation,

reflection,

overall

))

Run via:

* Nightly cron
* Weekly cron (recommended Sunday midnight)

**1.3 PHP Trend Display (Learner View)**

**engagement\_trend.php**

$result = $conn->query("

SELECT week\_start, overall\_engagement

FROM engagement\_weekly\_trends

WHERE learner\_id=1

ORDER BY week\_start DESC

LIMIT 4

");

while($row=$result->fetch\_assoc()){

echo "<p>Week of ".$row['week\_start']." : ".$row['overall\_engagement']."</p>";

}

**Visual Recommendation**

* Use simple line graph (Chart.js)
* No colors indicating failure
* Neutral tone (blue/grey)

**1.4 Learner Microcopy (Trend Section)**

**Title:**  
Your Recent Engagement Pattern

**Body:**  
This shows how your interaction with learning activities has varied over the past few weeks.  
Fluctuations are natural. Engagement changes with workload, priorities, and focus.

**Important Line:**  
This does not measure ability or performance.

**2️⃣ Journey-Area Heatmaps**

**Objective**

Provide visibility into **where engagement is happening**, not how well someone is doing.

**2.1 Data Aggregation for Heatmap**

Add query in Python:

cursor.execute("""

SELECT journey\_area, SUM(event\_weight) as score

FROM engagement\_events

WHERE learner\_id=%s

AND created\_on >= NOW() - INTERVAL 30 DAY

GROUP BY journey\_area

""", (learner\_id,))

Store into:

CREATE TABLE engagement\_area\_summary (

learner\_id INT,

journey\_area VARCHAR(50),

engagement\_score FLOAT,

calculated\_on DATETIME

);

**2.2 PHP Heatmap Display**

**engagement\_heatmap.php**

$result = $conn->query("

SELECT journey\_area, engagement\_score

FROM engagement\_area\_summary

WHERE learner\_id=1

");

while($row=$result->fetch\_assoc()){

echo "<div class='heat-block'>";

echo $row['journey\_area']." : ".$row['engagement\_score'];

echo "</div>";

}

**2.3 Heatmap UX Rules**

* Use gradient intensity (light → darker)
* Never use red for low
* Never show rankings
* Never show peer comparison

**2.4 Learner Microcopy (Heatmap Section)**

**Title:**  
Where Your Engagement Is Concentrated

**Body:**  
This view reflects which areas of your learning journey you’ve interacted with recently.

Some learners focus deeply in one area. Others distribute their time across multiple areas. Both patterns are valid.

**3️⃣ Refined Learner-Facing Microcopy (Full Set)**

Below is the **complete engagement section microcopy** you should standardize.

**Main Dashboard Engagement Card**

**Title:**  
Your Engagement Snapshot

**Body:**  
This reflects how you’ve been interacting with your learning journey recently.

It measures activity and participation patterns — not performance, grades, or ability.

**Presence Indicator**

Shows how consistently you’ve been logging into and accessing learning spaces.

**Interaction Indicator**

Shows how actively you’ve been engaging with content, tools, or exercises.

**Participation Indicator**

Shows your involvement in collaborative or project-based activities.

**Reflection Indicator**

Shows moments where you revisited, reviewed, or paused to think.

**Overall Engagement Note**

Engagement levels naturally change over time. Periods of lower activity are common and do not imply reduced capability or commitment.

**4️⃣ Faculty View (Extended for Trends + Heatmap)**

Faculty Dashboard Should Include:

* 4-week trend line
* Journey-area heatmap
* No labels like “at-risk”
* No automatic alerts

**Faculty Microcopy**

Engagement trends provide context about participation patterns.  
They should be interpreted alongside conversation and mentorship — not as standalone indicators.

**5️⃣ Architecture Summary (Extended)**

Your module now includes:

Engagement Events (raw)

↓

Weekly Aggregation (Python batch)

↓

Trend Storage

↓

Area Heatmap Summary

↓

Learner & Faculty Visualization

Still:

* No predictive models
* No adaptive triggers
* No automated consequences

**6️⃣ Why This Strengthens Astraal LXP**

You now have:

* Temporal visibility (trend)
* Spatial visibility (journey heatmap)
* Human-centered language
* Ethical boundaries
* Institution-ready analytics

Most platforms confuse engagement with performance.  
You are cleanly separating them.