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Athlete 360: Leveraging HPCC Systems and RealBI for Athlete Wellness and Performance

HPCC SYSTEMS®

Athlete360

Athlete Wellness Platform

- Many factors that affect an athlete's ability to perform daily
- Collect data to quantify training loads and stresses on athletes
- Clean, organize, and process this data to find the information that is impactful
- Quick and easy method for data consumption

End Goal

Automated data upload/storage

Automated data analysis

Automated custom reports

Custom permissions

Data Security

Athlete portal

Conversations around data to improve effectiveness of work

Catalyst for communication

Impacts

Pack Performance

- Sports Medicine Staff
  - Athletic Trainers
  - Injury risk
  - Return to play
- Sports Nutrition Staff
  - fueling for sport
  - Maintaining healthy weight
- Sports Psychology Staff
  - Stress outside of sport
  - Academic, social, family, etc.
- Sports Administration Staff
  - Seeing the whole picture

Women's Basketball data

- Catapult GPS devices
- Indoors, so no positional data
  - Accelerometer data
- Velocity, jumps, IMAs, training loads
- Practices and games

HPCC SYSTEMS®

System Setup

- Pull data from Catapult cloud
- Upload data to landing zone
- Spray data across the cluster
- Run ECL scripts to clean and process data

- Run ECL scripts to manipulate for analysis
- Pull data from cluster into RealBI
- Provide WBB dashboard with different report tabs based on information needed

Differences from Bare Metal to Kubernetes

- Script for upload
  - Azure fileshare
- Script for spraying data
  - SourcePlane rather than IP
- Script for processing data
  - Thor/pod shutdowns
  - Config of cluster

WBB_gps

```
// do all preprocessing actions and get the cleaned data from spray
stgLayout extractdata (Athlete360.Layouts.WBBgps_I):= transform
    SELF.date := STD.date.fromstringtodate(L.date,'%m/%d/%Y');
    SELF.Name := STD.str.filterout(L.Name,'"');
    SELF.Period := STD.str.filterout(L.Period,'"');
    SELF.Periodnum := (UNSIGNED3)L.Periodnum;
    SELF.Periodid := 0;
    SELF.Position := L.Position;
    SELF.IMATotal := (UNSIGNED2)L.IMATotal;
    SELF.PlayerLoad := (DECIMAL5_2)L.PlayerLoad;
    SELF.PlayerLoadpermin:= (DECIMAL5_2)L.PlayerLoadpermin;
    SELF.TRIMP := (DECIMAL5_2)L.TRIMP;
    SELF.TRIMPpermin := (DECIMAL5_2)L.TRIMPpermin;
    SELF.endtime := std.date.fromstringtotime(L.endtime,'%H:%M:%S');
    SELF.starttime := std.date.fromstringtotime(L.starttime,'%H:%M:%S');
    SELF.totaltime := std.date.fromstringtotime(L.totaltime,'%H:%M:%S');
    SELF.HRover85 := (UNSIGNED4)L.HRover85;
    SELF.HRexertion := (UNSIGNED3)L.HRexertion;
    SELF.MaxHR := (UNSIGNED2)L.MaxHR;
    SELF.exertionindex := (DECIMAL5_2)L.exertionindex;
    SELF.MaxAccel := (UNSIGNED2)L.MaxAccel;
    SELF.MaxDecel := (UNSIGNED2)L.MaxDecel;
    SELF.MaxVelocity := (UNSIGNED2)L.MaxVelocity;
    SELF.Acceldensity := (UNSIGNED2)L.Acceldensity;
    SELF.Acceldensityindex := (DECIMAL5_2)L.Acceldensityindex;
    SELF.IMAcount := (UNSIGNED2)L.IMAcount;
    SELF.IMAcodLmax := (UNSIGNED2)L.IMAcodLmax;
    SELF.IMAcodRmax := (UNSIGNED2)L.IMAcodRmax;
    SELF.Jumpstotal := (UNSIGNED2)L.Jumpstotal;
    SELF.Jumpspermin := (DECIMAL5_2)L.Jumpspermin;
    SELF.gamedaycount := ' ';
    SELF.week := 0;
    SELF.year := 0;
    SELF.daynum := 0;
    SELF.athleteid := 0;
    SELF.wuid := workunit;
END;

cleanedSprayFile := PROJECT(sprayFile, extractdata(LEFT));
```

WBB_gps

```
// after we get the cleaned spray, add wtih currently staged file, dedup by unique fields

finalStageData := DEDUP(
        SORT(
            cleanedSprayFile + Athlete360.files_stg.WBBgps_stgfile,
            NAME, DATE, Period, starttime, totaltime, -wuid),
        NAME, DATE, Period, starttime, totaltime
    );

mapfile := Athlete360.files_stg.athleteinfo_stgfile;

//now we link the stagedata with the athleteid related to the names from the athleteinfo file
completestgdata1 := join(finalStageData,

Athlete360.files_stg.Athleteinfo_stgfile,

Athlete360.util.toUpperTrim(left.name) = Athlete360.util.toUpperTrim(right.name),

transform({RECORDOF(LEFT)}, SELF.Athleteid := RIGHT.athleteid; SELF := LEFT;),

left outer

);
```

```
completestgdata2 := join(completestgdata1,

Athlete360.files_stg.WBBdate_stgfile,

left.date = right.date,

transform({RECORDOF(LEFT)},
        SELF.gamedaycount := RIGHT.gamedaycount;
        SELF.week := Right.week;
        SELF.daynum := Right.daynum;
        self.year := IF(left.date > 20180000 AND left.date < 20190000, 1,
                        IF(left.date > 20190000 AND left.date < 20200000, 2,
                        IF(left.date > 20200000 AND left.date < 20210000, 3, 4))),
        SELF := LEFT;),

left outer

);

completestgdata3 := sort(join(completestgdata2,

Athlete360.files_stg.WBBdrills_stgfile,

Athlete360.util.toUpperTrim(left.period) = Athlete360.util.toUpperTrim(right.period),

transform({RECORDOF(LEFT)},
        SELF.periodid := Right.Periodid;
        SELF := LEFT;),

left outer

),name,date);
```

WBB reports

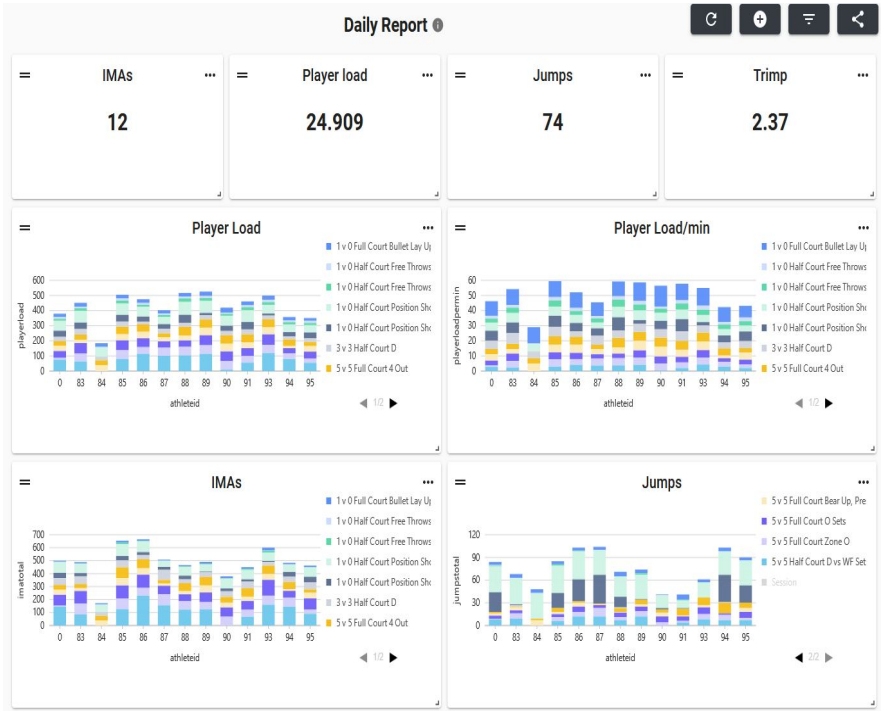
```
DATA_AVE_ID := SORT(
  TABLE(gpsdata1,
    {athleteid,date,period,
    decimal10_5 ave_PlayerLoad := AVE(group, PlayerLoad);
    decimal10_5 ave_PlayerLoadpermin := AVE(group, PlayerLoadpermin);
    decimal10_5 ave_TRIMP := AVE(group, TRIMP);
    decimal10_5 ave_TRIMPpermin := AVE(group, TRIMPpermin);
    unsigned4 ave_MaxVelocity := AVE(group, MaxVelocity);
    unsigned4 ave_IMATotal := AVE(group, IMATotal);
    unsigned4 ave_IMACount := AVE(group, IMACount);
    unsigned4 ave_JumpsTotal := AVE(group, JumpsTotal);
    decimal10_5 ave_Jumpspermin := AVE(group, Jumpspermin);
    },
    athleteid,date,period,
    MERGE
    ), athleteid,date,period
  );
```

```
gpsaverages := sort(join(gpsdata1, DATA_AVE_ID,
                Left.athleteid = Right.athleteid AND left.date = right.date AND left.period = right.period,
                Transform(temp2,
                        self.ave_playerload := right.ave_playerload;
                        self.ave_playerloadpermin := right.ave_playerloadpermin;
                        self.ave_trimp := right.ave_trimp;
                        self.ave_trimppermin := right.ave_trimppermin;
                        self.ave_maxvelocity := right.ave_maxvelocity;
                        self.ave_imatotal := right.ave_imatotal;
                        self.ave_imacount := right.ave_imacount;
                        self.ave_jumpstotal := right.ave_jumpstotal;
                        self.ave_jumpspermin := right.ave_jumpspermin;
                        Self := Left;
                        ),
                        INNER, ALL
                        ),athleteid,date,starttime,period);
```

Ways to make sense of the data

Fields to filter by	Date, week, year, gamedaycount, drills
Practices vs Games	Between practices, between games
Daily vs over time	Individual, positional, team
Breakdown of drills	From one practice, historical view

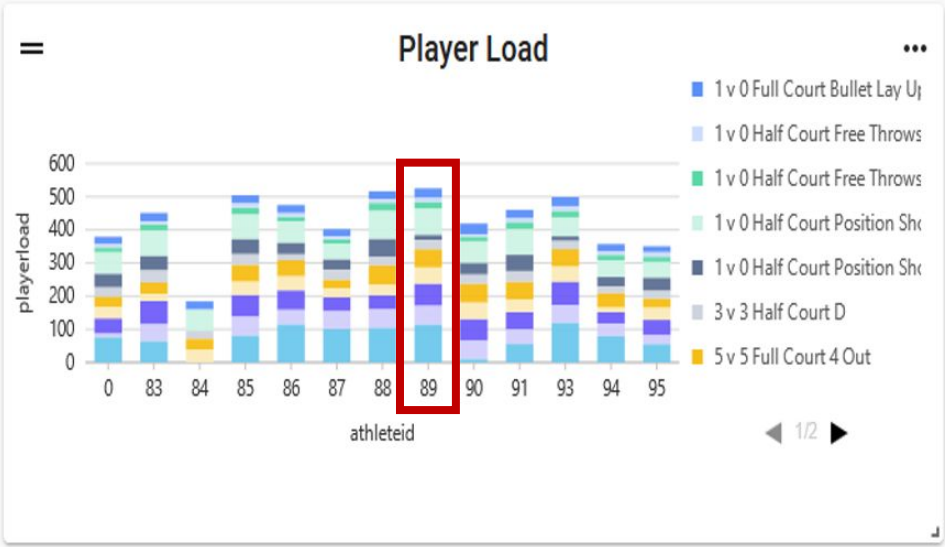
RealBI

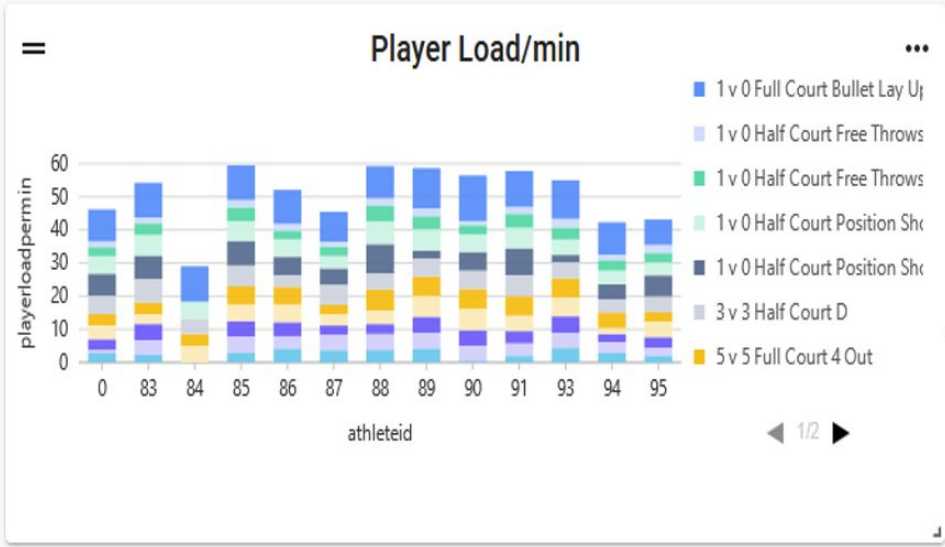


Overview

Athleteid	Ave_playerload	Ave_playerloadpermin	Ave_imatotal	Ave_jumpstotal	Ave_maxvelocity
0	379.43	3.54	500	84	0
83	451.3	4.21	489	68	0
84	184.33	5.04	172	48	0
85	504.51	4.7	654	85	0
86	475.1	4.43	665	103	0
87	402.18	3.75	508	104	0
88	516.85	4.82	466	71	0
89	525.56	4.9	491	74	0
90	419.39	3.91	379	41	0
91	460.66	4.3	450	41	0
93	499.1	4.65	601	61	0
94	357.35	3.33	484	103	0
95	350.75	3.27	462	90	0

Rows per page: 20 1-13 of 13


Player Load
playerload
600
500
400
300
200
100
0
0
83
84
85
86
87
88
89
90
91
93
94
95
athleteid
1/2
1 v 0 Full Court Bullet Lay U
1 v 0 Half Court Free Throws
1 v 0 Half Court Free Throws
1 v 0 Half Court Position Sh
1 v 0 Half Court Position Sh
3 v 3 Half Court D
5 v 5 Full Court 4 Out


Player Load/min
playerloadpermin
60
50
40
30
20
10
0
0
83
84
85
86
87
88
89
90
91
93
94
95
athleteid
1/2
1 v 0 Full Court Bullet Lay U
1 v 0 Half Court Free Throws
1 v 0 Half Court Free Throws
1 v 0 Half Court Position Sh
1 v 0 Half Court Position Sh
3 v 3 Half Court D
5 v 5 Full Court 4 Out

Overview

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91	460.66	4.3	450	41	0
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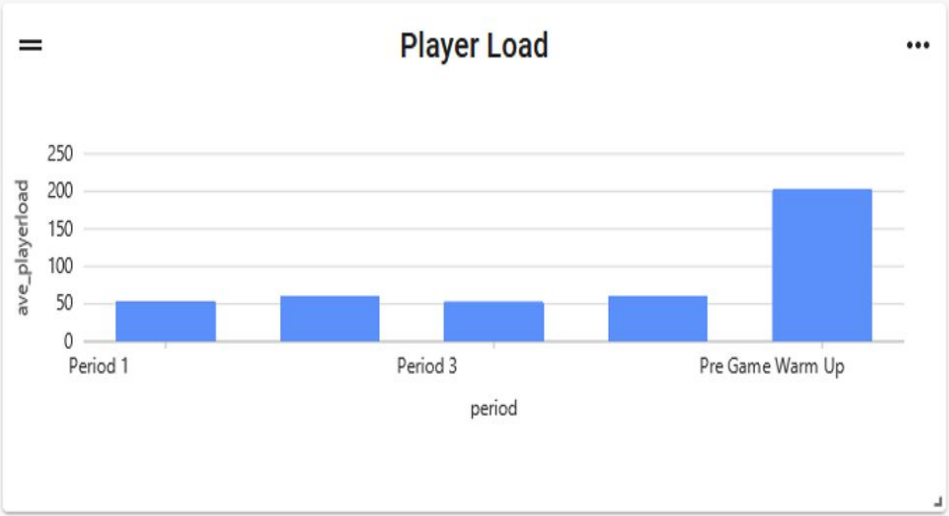
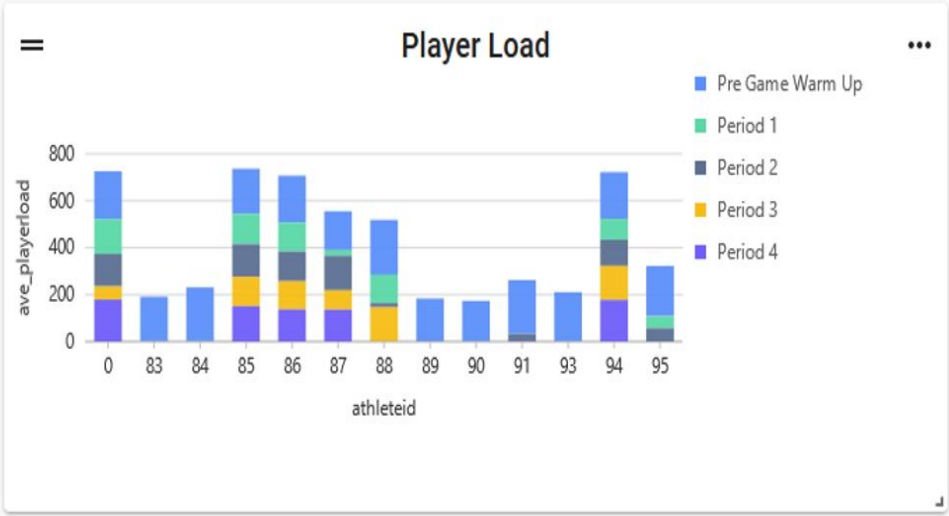
94	357.35	3.33	484	103	0
95	350.75	3.27	462	90	0

Rows per page: 20 1-13 of 13


Game Report
IMAs
123
Player Load
201.599
Jumps
81
TRIMP
58.88
Player Load
ave_playerload
period
Period 1
Period 3
Pre Game Warm Up
Player Load
ave_playerload
athleteid
Pre Game Warm Up
Period 1
Period 2
Period 3
Period 4
IMAs
ave_imatotal
period
IMA
ave_imatotal
athleteid
Jumps
ave_jumpstotal
period
Jumps
ave_jumpstotal
athleteid


Player Load
250
200
150
100
50
0
ave_playerload
Period 1
Period 3
Pre Game Warm Up
period

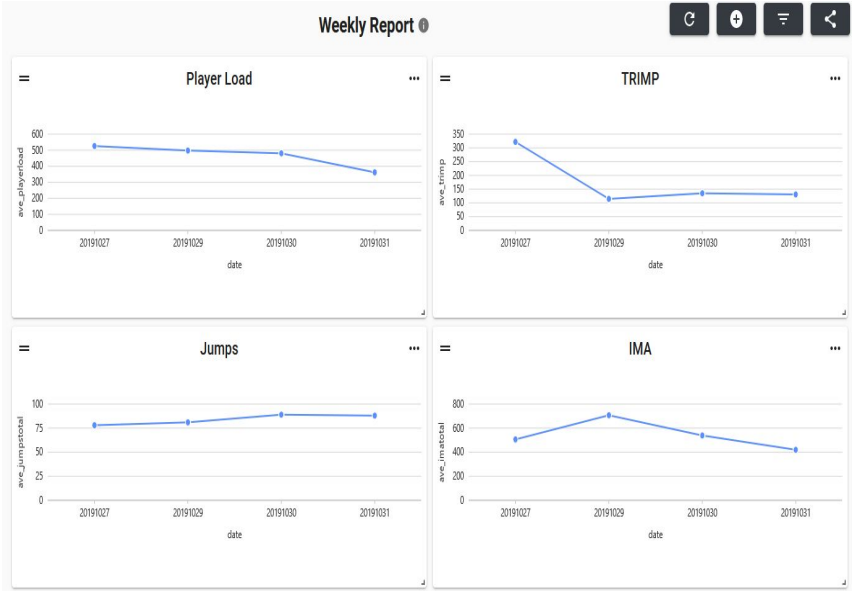

Player Load
Pre Game Warm Up
Period 1
Period 2
Period 3
Period 4
800
600
400
200
0
ave_playerload
0
83
84
85
86
87
88
89
90
91
93
94
95
athleteid

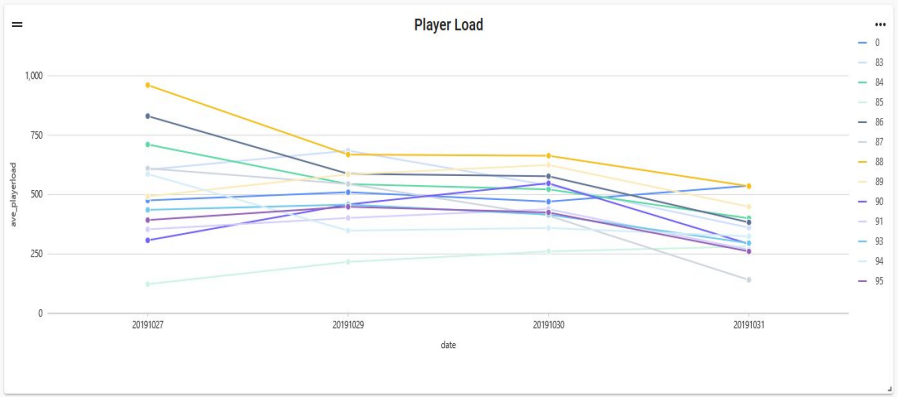
RealBI

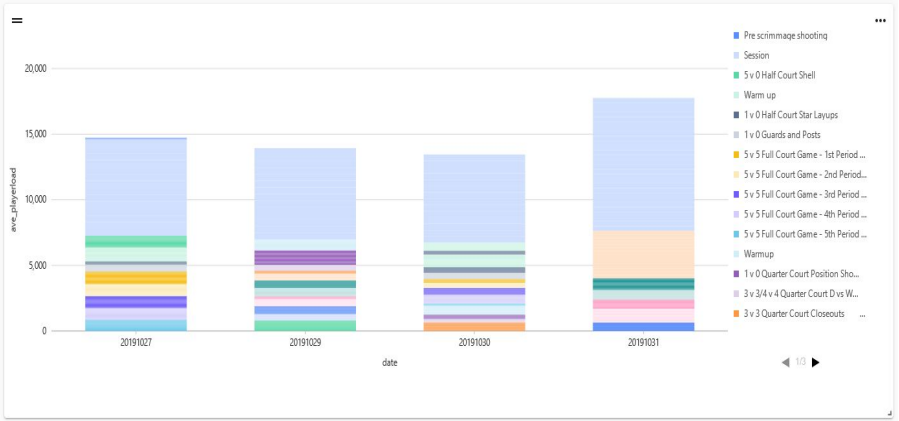
Did not play in game

Played in game

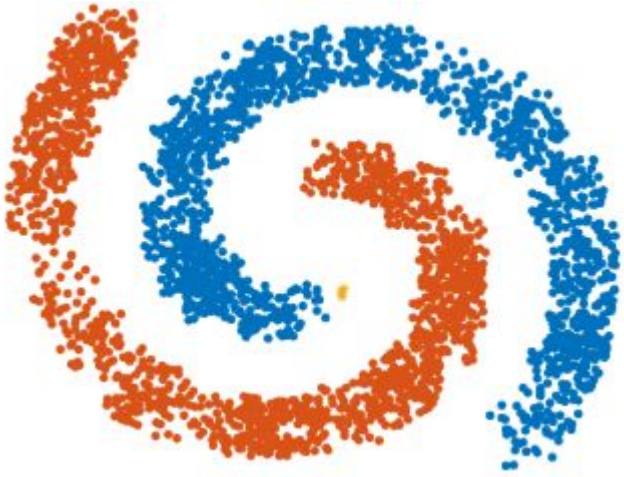
RealBI


Weekly Report
Player Load
ave_playerload
date
TRIMP
ave_trimp
date
Jumps
ave_jumpstotal
date
IMA
ave_imatotal
date


Player Load
ave_playerload
date


ave_playerload
date
Pre scrimmage shooting
Session
5 v 0 Half Court Shell
Warm up
1 v 0 Half Court Star Layups
1 v 0 Guards and Posts
5 v 5 Full Court Game - 1st Period ...
5 v 5 Full Court Game - 2nd Period...
5 v 5 Full Court Game - 3rd Period ...
5 v 5 Full Court Game - 4th Period ...
5 v 5 Full Court Game - 5th Period ...
Warmup
1 v 0 Quarter Court Position Sho...
3 v 3/4 v 4 Quarter Court D vs W...
3 v 3 Quarter Court Closeouts

Next Steps



- Cluster Analysis with DBSCAN
  - Comparison between drills
- What drills are high for what variable
- What drills are similar
- How drills differ from themselves on different days

Questions

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