Course activities address key points within the storyline.

Combining solar nebula theory with models of star formation predicts that planet formation is common in the Milky Way and can create planetary systems like our own, but can also create systems that include objects that do not exist in our solar system.

Planet properties give clues about formation of solar system.

How we find exoplanets determines what we can (and can't) know about them.

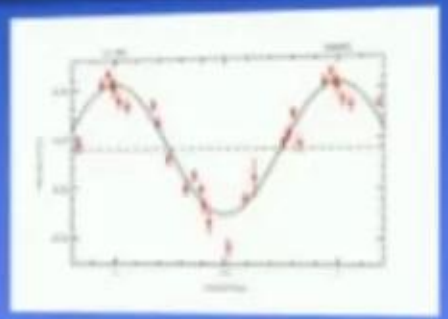

Image Credit: ESO

Planets are common within our galaxy.

Interactions between bodies in a system are important to that system's evolution.

Under the right conditions, other planets may also host life.

1
00:00:10,640 --> 00:00:09,230
alright so among everyone here I feel

2
00:00:13,730 --> 00:00:10,650
like I'm the odd person out cuz I'm here

3
00:00:15,560 --> 00:00:13,740
talking about education specifically and

4
00:00:18,170 --> 00:00:15,570
what I'm working on is developing a

5
00:00:19,760 --> 00:00:18,180
course on exoplanets that's going to be

6
00:00:22,250 --> 00:00:19,770
used for teaching in-service teachers

7
00:00:28,130 --> 00:00:22,260
and I'm doing this work with Chris Palma

8
00:00:30,349 --> 00:00:28,140
at Penn State ooh fancy so our main

9
00:00:32,319 --> 00:00:30,359
goals for this entire project are 21

10
00:00:35,030 --> 00:00:32,329
teach these these are going to be

11
00:00:36,709 --> 00:00:35,040
primarily late middle school and high

12
00:00:39,229 --> 00:00:36,719
school teachers teach them about

13
00:00:42,260 --> 00:00:39,239

exoplanets and to demonstrate good

14
00:00:43,970 --> 00:00:42,270
teaching pedagogy why would we do so so

15
00:00:45,380 --> 00:00:43,980
our course is designed I'll tell you

16
00:00:47,720 --> 00:00:45,390
what all these terms mean later don't

17
00:00:50,389 --> 00:00:47,730
worry around what we call a coherent

18
00:00:52,520 --> 00:00:50,399
content storyline the course is

19
00:00:54,650 --> 00:00:52,530
activity-based it's not so much the

20
00:00:56,779 --> 00:00:54,660
teachers go through and read things it's

21
00:00:58,220 --> 00:00:56,789
they're actually going to be doing

22
00:01:00,020 --> 00:00:58,230
things like the real own little

23
00:01:01,520 --> 00:01:00,030
experiments and to design those

24
00:01:03,319 --> 00:01:01,530
activities we're using a framework

25
00:01:05,690 --> 00:01:03,329
that's known as claims evidence

26
00:01:07,429 --> 00:01:05,700
reasoning from McNeil and create check

27
00:01:10,850 --> 00:01:07,439
you can read about it in this actually

28
00:01:12,020 --> 00:01:10,860
book of theirs and more importantly

29
00:01:14,600 --> 00:01:12,030
we're going to make the inner workings

30
00:01:17,390 --> 00:01:14,610
of this course completely transparent to

31
00:01:19,219 --> 00:01:17,400
our student teachers and we're going to

32
00:01:20,450 --> 00:01:19,229
make all the materials that we create

33
00:01:22,760 --> 00:01:20,460
for this course available online

34
00:01:24,560 --> 00:01:22,770
publicly to anyone who wants them on

35
00:01:26,990 --> 00:01:24,570
difference is if you take the course for

36
00:01:31,340 --> 00:01:27,000
credit you actually get some credit for

37
00:01:35,600 --> 00:01:31,350
it so go here in content storyline is a

38
00:01:38,840 --> 00:01:35,610

way to organize a course you start off

39
00:01:42,140 --> 00:01:38,850
with some underlying big idea this is

40
00:01:44,389 --> 00:01:42,150
your goal for what you want to teach its

41
00:01:48,249 --> 00:01:44,399
people in the class usually you tie this

42
00:01:50,810 --> 00:01:48,259
to some phenomenon or some causal model

43
00:01:53,420 --> 00:01:50,820
from there you develop what we call your

44
00:01:57,319 --> 00:01:53,430
upper anchor and this is aside from just

45
00:02:00,649 --> 00:01:57,329
this big idea like saying exoplanets you

46
00:02:04,249 --> 00:02:00,659
have to specifically lay out what your

47
00:02:05,840 --> 00:02:04,259
learning goals are for the class from

48
00:02:08,589 --> 00:02:05,850
this point once you figure out what your

49
00:02:10,669 --> 00:02:08,599
learning goals are you have to go okay

50
00:02:12,470 --> 00:02:10,679
so if I want them to understand this

51
00:02:13,370 --> 00:02:12,480
this this and this what do I have to

52
00:02:15,860 --> 00:02:13,380
teach them

53
00:02:17,330 --> 00:02:15,870
and those your horse topics finally from

54
00:02:20,150 --> 00:02:17,340
the chorus topics you can then determine

55
00:02:23,510 --> 00:02:20,160
what the lessons and activities for the

56
00:02:26,480 --> 00:02:23,520
course are of course there's a bit of a

57
00:02:29,360 --> 00:02:26,490
problem with this as of now we still

58
00:02:32,720 --> 00:02:29,370
don't have a single underlying theory

59
00:02:34,550 --> 00:02:32,730
that explains all of exoplanets we have

60
00:02:36,650 --> 00:02:34,560
a bunch of things from different places

61
00:02:39,710 --> 00:02:36,660
that we've kind of mashed together have

62
00:02:41,810 --> 00:02:39,720
ideas from solar nebula Theory our ideas

63
00:02:44,150 --> 00:02:41,820

for models of stellar formation and how

64
00:02:46,760 --> 00:02:44,160
those stars evolve we have the nice

65
00:02:48,950 --> 00:02:46,770
model which talks about how planets in

66
00:02:52,280 --> 00:02:48,960
our solar system didn't necessarily form

67
00:02:53,600 --> 00:02:52,290
where we find them now in fact Uranus

68
00:02:56,300 --> 00:02:53,610
and Neptune have switched places

69
00:02:58,490 --> 00:02:56,310
Jupiter's moved in and then moved out so

70
00:03:00,890 --> 00:02:58,500
planetary migrations are important to

71
00:03:03,410 --> 00:03:00,900
how these exoplanets systems form and

72
00:03:05,680 --> 00:03:03,420
how we observe them today and of course

73
00:03:07,910 --> 00:03:05,690
we have planetary evolution and

74
00:03:10,460 --> 00:03:07,920
Atmospheric evolution if you want to get

75
00:03:12,860 --> 00:03:10,470
into things like habitability of these

76
00:03:15,200 --> 00:03:12,870
plants which you know everyone here does

77
00:03:16,940 --> 00:03:15,210
I'm sure and it's one of those topics

78
00:03:18,680 --> 00:03:16,950
that is very important for people to

79
00:03:21,020 --> 00:03:18,690
understand when talking about exoplanets

80
00:03:26,750 --> 00:03:21,030
because in large part it motivates our

81
00:03:29,630 --> 00:03:26,760
entire our entire study of exoplanets so

82
00:03:31,610 --> 00:03:29,640
as our central phenomenon what we tie

83
00:03:33,650 --> 00:03:31,620
everything in the course back to we're

84
00:03:35,420 --> 00:03:33,660
going to choose the Kepler ory now this

85
00:03:38,960 --> 00:03:35,430
is not perfect but what we want to

86
00:03:42,770 --> 00:03:38,970
demonstrate is the diversity present in

87
00:03:43,910 --> 00:03:42,780
exoplanet systems that we observe so of

88
00:03:47,660 --> 00:03:43,920

course one thing you're missing from

89
00:03:50,570 --> 00:03:47,670
this is those really strange systems

90
00:03:53,420 --> 00:03:50,580
with very high centricity planets but

91
00:03:56,449 --> 00:03:53,430
that's an indent immed going to say okay

92
00:03:58,220 --> 00:03:56,459
the Kepler Ori is great all the plants

93
00:04:00,440 --> 00:03:58,230
we found here but it's not complete and

94
00:04:02,030 --> 00:04:00,450
here's why of course the students are

95
00:04:03,650 --> 00:04:02,040
going to figure that out themselves as

96
00:04:08,930 --> 00:04:03,660
well but it's going to be something that

97
00:04:12,199 --> 00:04:08,940
is explained pretty explicitly the

98
00:04:13,730 --> 00:04:12,209
course activities are tied to these key

99
00:04:17,479 --> 00:04:13,740
points than the story line and this is

100
00:04:20,840 --> 00:04:17,489
basically so this is our um later okay

101
00:04:22,640 --> 00:04:20,850
this is our upper anchor and reads that

102
00:04:24,800 --> 00:04:22,650
combining solar nebula theory with

103
00:04:27,230 --> 00:04:24,810
models of star formation predicts that

104
00:04:29,300 --> 00:04:27,240
planet formation is common

105
00:04:32,150 --> 00:04:29,310
in the Milky Way and can create

106
00:04:34,520 --> 00:04:32,160
planetary systems like our own but also

107
00:04:37,610 --> 00:04:34,530
create systems that contain objects that

108
00:04:39,170 --> 00:04:37,620
do not exist inside our solar system so

109
00:04:41,420 --> 00:04:39,180
this is including you know we're looking

110
00:04:44,020 --> 00:04:41,430
for things like our own system things

111
00:04:46,370 --> 00:04:44,030
with habitable planets gas giants

112
00:04:49,159 --> 00:04:46,380
potentially ice giants somewhere out

113
00:04:53,480 --> 00:04:49,169

there but we also have things to explain

114
00:04:55,580 --> 00:04:53,490
like hot Jupiters super Earths mini

115
00:04:59,360 --> 00:04:55,590
Neptune's and all these things in

116
00:05:01,219 --> 00:04:59,370
totally weird places in their planetary

117
00:05:05,089 --> 00:05:01,229
systems compared to what we think of

118
00:05:07,520 --> 00:05:05,099
when we look at our own solar system so

119
00:05:10,790 --> 00:05:07,530
to break this up what we have to look at

120
00:05:13,100 --> 00:05:10,800
and taste them about is planet

121
00:05:15,409 --> 00:05:13,110
properties in our solar system give us

122
00:05:19,339 --> 00:05:15,419
an idea of how our solar system was

123
00:05:21,170 --> 00:05:19,349
formed so look at where the rocky plants

124
00:05:23,450 --> 00:05:21,180
are where the gas plants are where the

125
00:05:25,820 --> 00:05:23,460
ice planets are and they give this idea

126
00:05:29,059 --> 00:05:25,830
of these formation of our formation

127
00:05:30,230 --> 00:05:29,069
history of our solar system then they

128
00:05:32,029 --> 00:05:30,240
need to know about how we find

129
00:05:33,439 --> 00:05:32,039
exoplanets the main things that we're

130
00:05:35,810 --> 00:05:33,449
going to be covering are the two biggest

131
00:05:38,180 --> 00:05:35,820
ones radial velocity method and transit

132
00:05:41,180 --> 00:05:38,190
method and then what these methods can

133
00:05:42,680 --> 00:05:41,190
tell us about these exoplanets systems

134
00:05:44,149 --> 00:05:42,690
and these exoplanets in general because

135
00:05:46,279 --> 00:05:44,159
you don't get the same information from

136
00:05:50,089 --> 00:05:46,289
each radial velocity gives you things

137
00:05:52,430 --> 00:05:50,099
like mass whereas transit gives you

138
00:05:56,510 --> 00:05:52,440

things like the size of the planet and

139
00:05:59,390 --> 00:05:56,520
obviously a lot more than just that next

140
00:06:01,420 --> 00:05:59,400
want to hit them with the idea that

141
00:06:05,209 --> 00:06:01,430
planets are common within our galaxy

142
00:06:07,129 --> 00:06:05,219
this is one of the biggest results out

143
00:06:09,649 --> 00:06:07,139
of the Kepler mission planets are

144
00:06:11,809 --> 00:06:09,659
literally everywhere and we expect them

145
00:06:15,760 --> 00:06:11,819
to be able to respect every star to have

146
00:06:18,770 --> 00:06:15,770
at least one planet on average of course

147
00:06:20,930 --> 00:06:18,780
then from there start talking about

148
00:06:23,510 --> 00:06:20,940
interactions between these bodies this

149
00:06:25,249 --> 00:06:23,520
is the stuff that in our solar system we

150
00:06:28,309 --> 00:06:25,259
know as the nice model but also gives

151
00:06:30,649 --> 00:06:28,319
rise to things like hot Jupiters that

152
00:06:32,450 --> 00:06:30,659
the interactions between these objects

153
00:06:36,200 --> 00:06:32,460
in the system are important to that

154
00:06:37,640 --> 00:06:36,210
systems evolution finally I want to talk

155
00:06:39,230 --> 00:06:37,650
about habitability once you've gone

156
00:06:40,910 --> 00:06:39,240
through all of these we can start to get

157
00:06:43,900 --> 00:06:40,920
to the idea that

158
00:06:47,450 --> 00:06:43,910
under the right conditions other planets

159
00:06:51,350 --> 00:06:47,460
may also host life this of course is a

160
00:06:52,910 --> 00:06:51,360
big may underlined boldface italics you

161
00:06:56,240 --> 00:06:52,920
probably increase the font size a bit as

162
00:06:58,010 --> 00:06:56,250
well but it's one of the things that we

163
00:07:02,290 --> 00:06:58,020

really want to know and we really want

164
00:07:04,700 --> 00:07:02,300
to look for so the activities themselves

165
00:07:07,730 --> 00:07:04,710
the cleanse evidence freeze reasoning

166
00:07:09,560 --> 00:07:07,740
framework essentially is we're using it

167
00:07:12,440 --> 00:07:09,570
because it one teaches course material

168
00:07:13,790 --> 00:07:12,450
and two teaches the scientific practice

169
00:07:15,980 --> 00:07:13,800
and both of these are incredibly

170
00:07:18,140 --> 00:07:15,990
important in large part because we're

171
00:07:20,860 --> 00:07:18,150
targeting this at the middle school high

172
00:07:23,240 --> 00:07:20,870
school audience where a lot of the

173
00:07:27,680 --> 00:07:23,250
material that we cover and standards are

174
00:07:30,350 --> 00:07:27,690
met are governed by NGSS and NGSS cover

175
00:07:34,190 --> 00:07:30,360
is actually puts huge emphasis on this

176
00:07:35,360 --> 00:07:34,200
scientific practices part so the example

177
00:07:38,300 --> 00:07:35,370
i'm going to give you here is actually

178
00:07:41,090 --> 00:07:38,310
from a paper by carrie Ann Rubin and the

179
00:07:43,370 --> 00:07:41,100
rest of the group in 2014 and using the

180
00:07:46,790 --> 00:07:43,380
example from a claims Evans reasoning

181
00:07:48,200 --> 00:07:46,800
activity with the question how can the

182
00:07:50,660 --> 00:07:48,210
plants be grouped according to their

183
00:07:52,490 --> 00:07:50,670
properties so students were given this

184
00:07:54,350 --> 00:07:52,500
question the given places they can look

185
00:07:57,050 --> 00:07:54,360
for the data and they start

186
00:07:59,240 --> 00:07:57,060
investigating this this class is broken

187
00:08:01,910 --> 00:07:59,250
up into groups and each group in this

188
00:08:04,550 --> 00:08:01,920

case takes a different property and kind

189
00:08:06,140 --> 00:08:04,560
of classifies the planets by it you know

190
00:08:08,390 --> 00:08:06,150
you may notice here that there aren't

191
00:08:10,490 --> 00:08:08,400
many numbers on this plot and that's

192
00:08:12,950 --> 00:08:10,500
totally okay this is a way of getting

193
00:08:15,230 --> 00:08:12,960
them to do quantitative reasoning that

194
00:08:17,600 --> 00:08:15,240
doesn't necessarily involve numbers so

195
00:08:20,290 --> 00:08:17,610
they've broken things like the mass of

196
00:08:24,740 --> 00:08:20,300
the planets into size of like small

197
00:08:30,530 --> 00:08:24,750
medium and large or in the case of this

198
00:08:32,120 --> 00:08:30,540
guy right here extra small then after

199
00:08:34,400 --> 00:08:32,130
addressing each of these individually

200
00:08:36,200 --> 00:08:34,410
the groups then bring their data

201
00:08:40,430 --> 00:08:36,210
together and then create a chart that

202
00:08:42,590 --> 00:08:40,440
looks something like this once they have

203
00:08:45,230 --> 00:08:42,600
this evidence collected and brought

204
00:08:46,400 --> 00:08:45,240
together they start to develop an answer

205
00:08:49,010 --> 00:08:46,410
this question they have the evidence

206
00:08:52,760 --> 00:08:49,020
they need to make their claims based on

207
00:08:54,560 --> 00:08:52,770
that evidence part of this also is that

208
00:08:57,940 --> 00:08:54,570
they need to determine what evidence is

209
00:09:00,500 --> 00:08:57,950
relevant to the question if we go back

210
00:09:03,800 --> 00:09:00,510
the we look at things like the tilt on

211
00:09:06,170 --> 00:09:03,810
the axis and that's nowhere in their

212
00:09:07,970 --> 00:09:06,180
evidence that's listed here so not

213
00:09:09,320 --> 00:09:07,980

everything is necessarily going to be

214
00:09:13,220 --> 00:09:09,330
relevant to what they're trying to

215
00:09:14,720 --> 00:09:13,230
figure out normally are not necessarily

216
00:09:15,950 --> 00:09:14,730
normally often there's a reasoning

217
00:09:17,600 --> 00:09:15,960
section that follows here so I have

218
00:09:19,850 --> 00:09:17,610
claims and evidence well what the heck's

219
00:09:22,040 --> 00:09:19,860
reasoning so for this actual activity

220
00:09:24,280 --> 00:09:22,050
there's no necessarily reasoning section

221
00:09:28,760 --> 00:09:24,290
but generally what this will entail is

222
00:09:31,160 --> 00:09:28,770
that the students then taking their

223
00:09:33,950 --> 00:09:31,170
claims Evans have to figure out why that

224
00:09:37,430 --> 00:09:33,960
works and that usually addresses some

225
00:09:38,900 --> 00:09:37,440
underlying phenomenon in the case of one

226
00:09:41,810 --> 00:09:38,910
of the activities that I've developed is

227
00:09:44,440 --> 00:09:41,820
talking about radial velocity Texans and

228
00:09:47,540 --> 00:09:44,450
how or what properties you can determine

229
00:09:49,310 --> 00:09:47,550
about a planetary system from the radial

230
00:09:53,620 --> 00:09:49,320
velocity method so the underlying

231
00:09:56,750 --> 00:09:53,630
phenomenon there would mostly be gravity

232
00:09:58,820 --> 00:09:56,760
so they have to work through everything

233
00:10:01,130 --> 00:09:58,830
they see and come to some judgment about

234
00:10:04,040 --> 00:10:01,140
what is working here now for this

235
00:10:05,780 --> 00:10:04,050
particular activity what we do is they

236
00:10:07,850 --> 00:10:05,790
go through these regular solar system

237
00:10:10,580 --> 00:10:07,860
objects and one of the things that they

238
00:10:13,520 --> 00:10:10,590

identify that you see here is that Pluto

239
00:10:15,950 --> 00:10:13,530
is in a completely different class from

240
00:10:17,930 --> 00:10:15,960
all the other planets so we introduce

241
00:10:20,840 --> 00:10:17,940
them to the Kuiper belt objects and they

242
00:10:23,690 --> 00:10:20,850
start looking up this same data for all

243
00:10:26,210 --> 00:10:23,700
those and come the conclusion they reach

244
00:10:29,930 --> 00:10:26,220
this completely on their own I should

245
00:10:32,060 --> 00:10:29,940
mention that Pluto belongs with all of

246
00:10:33,950 --> 00:10:32,070
these things instead of with the rest of

247
00:10:39,650 --> 00:10:33,960
the solar system it's really really cool

248
00:10:42,320 --> 00:10:39,660
to see so that's all I have to say I

249
00:10:43,100 --> 00:10:42,330
kept this talk short because most you

250
00:10:44,720 --> 00:10:43,110
probably don't know that much about

251
00:10:49,850 --> 00:10:44,730
education I assume there will be plenty

252
00:11:03,350 --> 00:11:01,460
I mean you'd have to ask hi your first

253
00:11:04,699 --> 00:11:03,360
of all not the only one I'm actually

254
00:11:07,990 --> 00:11:04,709
playing two jobs in science education

255
00:11:10,100 --> 00:11:08,000
right now awesomer you got it no I'm not

256
00:11:12,440 --> 00:11:10,110
but I would love to talk with you more

257
00:11:14,420 --> 00:11:12,450
about that one of the questions I have

258
00:11:16,100 --> 00:11:14,430
is as you're developing this course are

259
00:11:17,810 --> 00:11:16,110
you working with teachers and you're

260
00:11:20,840 --> 00:11:17,820
actually trying to implement like test

261
00:11:22,940 --> 00:11:20,850
us out in classes separately or in the

262
00:11:23,990 --> 00:11:22,950
future so actually once I've got

263
00:11:25,490 --> 00:11:24,000

everything developed that's going to be

264
00:11:27,170 --> 00:11:25,500
done by the end of this summer in the

265
00:11:28,790 --> 00:11:27,180
fall we have a bunch of teacher

266
00:11:31,009 --> 00:11:28,800
volunteers that are going to be going

267
00:11:33,350 --> 00:11:31,019
through this and then we're gonna get

268
00:11:35,420 --> 00:11:33,360
feedback on that evaluate what we have

269
00:11:37,910 --> 00:11:35,430
probably tweak some things but

270
00:11:51,290 --> 00:11:37,920
fundamentally yes we have to make this

271
00:11:53,300 --> 00:11:51,300
work for the teachers thank you hi

272
00:11:55,759 --> 00:11:53,310
you're a very good speaker oh thank you

273
00:11:59,660 --> 00:11:55,769
so this might be a controversial subject

274
00:12:01,130 --> 00:11:59,670
but do you think you'll run into parents

275
00:12:03,319 --> 00:12:01,140
of students in middle school in high

276
00:12:07,310 --> 00:12:03,329
school that don't think exoplanets are a

277
00:12:09,590 --> 00:12:07,320
thing and that like you might it's

278
00:12:12,880 --> 00:12:09,600
entirely possible it's not something

279
00:12:16,759 --> 00:12:12,890
I've considered though however um I

280
00:12:18,769 --> 00:12:16,769
quits with any luck bear with any luck

281
00:12:20,360 --> 00:12:18,779
the students will then be able to go

282
00:12:21,470 --> 00:12:20,370
home and tell their plants about what

283
00:12:23,750 --> 00:12:21,480
tell their parents about what they're

284
00:12:26,630 --> 00:12:23,760
learning and maybe from their parents

285
00:12:28,550 --> 00:12:26,640
maybe oh there is something else that

286
00:12:32,300 --> 00:12:28,560
could be out there that's interesting

287
00:12:33,319 --> 00:12:32,310
because a lot of a lot of what the what

288
00:12:35,060 --> 00:12:33,329

parents will be learning about

289
00:12:38,329 --> 00:12:35,070
exoplanets is probably gonna be coming

290
00:12:40,400 --> 00:12:38,339
from their kids because what where else

291
00:12:42,460 --> 00:12:40,410
are you getting lessons about exoplanets

292
00:12:44,720 --> 00:12:42,470
it's mostly in undergraduate education

293
00:12:46,310 --> 00:12:44,730
so the part of the goal of this is

294
00:12:48,560 --> 00:12:46,320
branching out further to move this

295
00:12:49,790 --> 00:12:48,570
knowledge lower down so we start talking

296
00:12:51,500 --> 00:12:49,800
about it in high school and middle

297
00:12:55,189 --> 00:12:51,510
school because it's one of those things

298
00:12:57,110 --> 00:12:55,199
that's just really cool that's one way

299
00:12:59,000 --> 00:12:57,120
that a lot of people have gotten really

300
00:13:01,699 --> 00:12:59,010
interested in astronomy by thinking

301
00:13:03,630 --> 00:13:01,709
about why else could there be life and

302
00:13:05,730 --> 00:13:03,640
then the consequences of everything

303
00:13:10,380 --> 00:13:05,740
from that on the astronomy side leading

304
00:13:11,970 --> 00:13:10,390
to studies of exoplanets so I'll I'd

305
00:13:14,010 --> 00:13:11,980
love to find out what happens with that

306
00:13:16,020 --> 00:13:14,020
hopefully i'll be done with my degree by

307
00:13:21,990 --> 00:13:16,030
then and someone else can study that

308
00:13:25,560 --> 00:13:22,000
there was another one nope really good

309
00:13:27,420 --> 00:13:25,570
talk good job um so in teaching a lot of

310
00:13:31,410 --> 00:13:27,430
the emphasis nowadays I feel like is

311
00:13:34,170 --> 00:13:31,420
being placed on assessment so is this

312
00:13:35,940 --> 00:13:34,180
are there tests are their quizzes is

313
00:13:38,790 --> 00:13:35,950

there a self-assessment like what's the

314
00:13:42,450 --> 00:13:38,800
best method of doing student assessment

315
00:13:43,950 --> 00:13:42,460
for how they show in this case so

316
00:13:45,600 --> 00:13:43,960
there's actually a course that's run at

317
00:13:48,690 --> 00:13:45,610
Penn State for teachers that does this

318
00:13:50,340 --> 00:13:48,700
already but it's a different set of

319
00:13:52,260 --> 00:13:50,350
activities it does use the solar system

320
00:13:55,380 --> 00:13:52,270
one but the assessments and that

321
00:13:58,290 --> 00:13:55,390
generally tend to be you know a wrap a

322
00:14:00,240 --> 00:13:58,300
kind of a wrap up style paper on the

323
00:14:04,260 --> 00:14:00,250
particular experiments the ones that are

324
00:14:06,720 --> 00:14:04,270
done in the full CER style and just

325
00:14:08,730 --> 00:14:06,730
general notebooks on stuff like that

326
00:14:10,890 --> 00:14:08,740
then they keep track of what they've

327
00:14:13,920 --> 00:14:10,900
done what they're doing as well so it's

328
00:14:16,410 --> 00:14:13,930
kind of an ongoing form of assessment

329
00:14:17,880 --> 00:14:16,420
that keeps track of you know you're not

330
00:14:20,550 --> 00:14:17,890
having them fill out tests or anything

331
00:14:22,710 --> 00:14:20,560
but it's kind of a rubric based system

332
00:14:25,140 --> 00:14:22,720
where you're following along with okay

333
00:14:29,970 --> 00:14:25,150
how are they being able to follow this

334
00:14:37,680 --> 00:14:29,980
are they doing this properly any other

335
00:14:41,040 --> 00:14:37,690
questions oh I have a comment to the

336
00:14:42,630 --> 00:14:41,050
previous question actually so my advisor

337
00:14:46,740 --> 00:14:42,640
has been teaching a course correction

338
00:14:50,220 --> 00:14:46,750

try show life in texas austin for poly

339
00:14:53,820 --> 00:14:50,230
15 16 years and a TA for a last semester

340
00:14:56,550 --> 00:14:53,830
more than forty percent of students went

341
00:15:00,420 --> 00:14:56,560
into that class living that creationism

342
00:15:05,280 --> 00:15:00,430
is as valid as evolution as a scientific

343
00:15:07,980 --> 00:15:05,290
theory and i was after a semester that

344
00:15:10,260 --> 00:15:07,990
the course went well and it was a very

345
00:15:15,450 --> 00:15:10,270
heavy class but the students learned a

346
00:15:19,870 --> 00:15:18,460
yay I'll also point out also point out

347
00:15:22,870 --> 00:15:19,880
that you mentioned that was Texas

348
00:15:26,380 --> 00:15:22,880
specifically and Mark Pennsylvania at

349
00:15:28,600 --> 00:15:26,390
least does not have um you know creation

350
00:15:31,150 --> 00:15:28,610
or anything similar in the standards for

351
00:15:32,920 --> 00:15:31,160
science education it's also completely

352
00:15:34,960 --> 00:15:32,930
left out of NGSS they've just like

353
00:15:37,990 --> 00:15:34,970
kicked it to the curb and said no we