2017 Astrobiology Graduate Conference

Charlottesville, VA

1
00:00:00,790 --> 00:00:08,320
[Music]

2
00:00:14,509 --> 00:00:11,990
hey everyone your favorite astronomy

3
00:00:17,269 --> 00:00:14,519
education guys back and for those you

4
00:00:18,710 --> 00:00:17,279
who those who are new and we're not did

5
00:00:21,920 --> 00:00:18,720
not see me last year don't worry I'll be

6
00:00:24,230 --> 00:00:21,930
your favorite very soon so I'm Dani

7
00:00:25,790 --> 00:00:24,240
behringer I'm a graduate student at Penn

8
00:00:28,460 --> 00:00:25,800
State in the department of curriculum

9
00:00:30,050 --> 00:00:28,470
and instruction now had a bit of a weird

10
00:00:32,089 --> 00:00:30,060
path through grad school you can totally

11
00:00:33,139 --> 00:00:32,099
talk to me about that later I'm going to

12
00:00:34,790 --> 00:00:33,149
be telling you about some of the work

13
00:00:36,830 --> 00:00:34,800

I've been doing I started doing it with

14
00:00:39,170 --> 00:00:36,840
Chris Palma but this past semester Rick

15
00:00:42,410 --> 00:00:39,180
do Shiell has gotten involved as well

16
00:00:44,330 --> 00:00:42,420
with the the really in-depth part of the

17
00:00:46,190 --> 00:00:44,340
development of this coherent content

18
00:00:48,770 --> 00:00:46,200
storyline on exoplanets I'm going to

19
00:00:50,869 --> 00:00:48,780
tell you about the first may give you a

20
00:00:52,670 --> 00:00:50,879
bit of a summary of what I talked about

21
00:00:56,180 --> 00:00:52,680
last year because this is all relevant

22
00:01:00,110 --> 00:00:56,190
so I'm developing a course for Penn

23
00:01:02,900 --> 00:01:00,120
State called Astro 850 which is a course

24
00:01:05,509 --> 00:01:02,910
that is designed for pre-service high

25
00:01:06,950 --> 00:01:05,519
school teachers on exoplanets that is

26
00:01:09,890 --> 00:01:06,960
going to be an elective course they can

27
00:01:14,539 --> 00:01:09,900
take as part of the immediate earth

28
00:01:16,760 --> 00:01:14,549
science program online and asteroid 50

29
00:01:18,710 --> 00:01:16,770
is designed to use activities designed

30
00:01:20,270 --> 00:01:18,720
around this claims evidence reasoning

31
00:01:23,330 --> 00:01:20,280
framework that sunny very briefly

32
00:01:26,060 --> 00:01:23,340
outlined for you and to engage students

33
00:01:27,469 --> 00:01:26,070
in authentic science practices I'll tell

34
00:01:29,630 --> 00:01:27,479
you a bit more about that later because

35
00:01:32,420 --> 00:01:29,640
it comes particularly relevant when we

36
00:01:36,140 --> 00:01:32,430
start talking about NGSS next generation

37
00:01:37,819 --> 00:01:36,150
science standards so for this talk I'm

38
00:01:40,490 --> 00:01:37,829

going to start by telling you what is a

39
00:01:44,749 --> 00:01:40,500
current content storyline in more detail

40
00:01:46,399 --> 00:01:44,759
and why does it matter then move on to

41
00:01:48,230 --> 00:01:46,409
the next generation Stein standards

42
00:01:51,770 --> 00:01:48,240
because this is a course that is being

43
00:01:53,719 --> 00:01:51,780
built for high school teachers it's

44
00:01:56,510 --> 00:01:53,729
incredibly important that we're

45
00:01:59,389 --> 00:01:56,520
including and taking into account the

46
00:02:02,300 --> 00:01:59,399
standards that high school students are

47
00:02:05,179 --> 00:02:02,310
going to be held to and then I'll talk a

48
00:02:08,180 --> 00:02:05,189
little bit about running these activity

49
00:02:10,400 --> 00:02:08,190
based courses in an online setting I had

50
00:02:12,740 --> 00:02:10,410
a little bit of practice doing this with

51
00:02:13,610 --> 00:02:12,750
the introductory lab class that I ran

52
00:02:16,250 --> 00:02:13,620
this past

53
00:02:18,740 --> 00:02:16,260
semester it was an in-person class in

54
00:02:20,809 --> 00:02:18,750
Italy but for some of the activities I

55
00:02:22,490 --> 00:02:20,819
admittedly use them as guinea pigs I

56
00:02:24,229 --> 00:02:22,500
mean what was worse that was going to

57
00:02:25,699 --> 00:02:24,239
happen so my last semester tieng are

58
00:02:28,160 --> 00:02:25,709
they going to like give me bad teach me

59
00:02:33,050 --> 00:02:28,170
reviews or something no this actually

60
00:02:35,170 --> 00:02:33,060
seem to enjoy them so why use a coherent

61
00:02:37,940 --> 00:02:35,180
content storyline and what really is it

62
00:02:40,640 --> 00:02:37,950
so the idea of a coherent content

63
00:02:44,569 --> 00:02:40,650

storyline goes back to a 2006 study

64
00:02:45,770 --> 00:02:44,579
which looked at a particular data set

65
00:02:49,250 --> 00:02:45,780
called the trends in international

66
00:02:53,740 --> 00:02:49,260
mathematics and science study TI MSS

67
00:02:57,199 --> 00:02:53,750
Tim's comparing the education or the

68
00:03:00,430 --> 00:02:57,209
instruction basically across a number of

69
00:03:03,949 --> 00:03:00,440
countries the video evidence showed that

70
00:03:06,559 --> 00:03:03,959
the United States compared to other

71
00:03:13,300 --> 00:03:06,569
high-performing countries while there

72
00:03:16,039 --> 00:03:13,310
were a lot of activity-based lessons the

73
00:03:18,890 --> 00:03:16,049
let the activities themselves lacked a

74
00:03:21,199 --> 00:03:18,900
strong connection to those lessons they

75
00:03:24,110 --> 00:03:21,209
were kind of a bunch of activities

76
00:03:27,080 --> 00:03:24,120
mashed together without some driving

77
00:03:29,629 --> 00:03:27,090
force behind them some larger

78
00:03:31,460 --> 00:03:29,639
organization this leads to another

79
00:03:34,339 --> 00:03:31,470
problem that was also observed with the

80
00:03:37,400 --> 00:03:34,349
United States where you get this mile

81
00:03:38,990 --> 00:03:37,410
wide inch deep problem of trying to

82
00:03:43,879 --> 00:03:39,000
cover a lot of material but only

83
00:03:45,680 --> 00:03:43,889
covering it at a very surface level so

84
00:03:48,229 --> 00:03:45,690
coherent content storyline is

85
00:03:50,780 --> 00:03:48,239
specifically a way to plan and organize

86
00:03:52,640 --> 00:03:50,790
a course yes for those you who are here

87
00:03:54,530 --> 00:03:52,650
last year I did use this slide already

88
00:03:58,280 --> 00:03:54,540

but it's a great one so I'm going to use

89
00:04:00,860 --> 00:03:58,290
it again um for coherent content

90
00:04:03,349 --> 00:04:00,870
storyline you want to start with what is

91
00:04:05,659 --> 00:04:03,359
the big idea that I'm trying to get

92
00:04:08,150 --> 00:04:05,669
across and this is going to be some kind

93
00:04:11,629 --> 00:04:08,160
of a phenomenon or causal model

94
00:04:14,360 --> 00:04:11,639
something like that once you know what

95
00:04:16,370 --> 00:04:14,370
you want to get across to them develop

96
00:04:18,949 --> 00:04:16,380
what's called the upper anchor statement

97
00:04:21,979 --> 00:04:18,959
this is the statement of the learning

98
00:04:24,409 --> 00:04:21,989
goals for this class basically what do I

99
00:04:26,750 --> 00:04:24,419
want the students to know coming out of

100
00:04:29,450 --> 00:04:26,760
my class

101
00:04:30,920 --> 00:04:29,460
there of course you can delve into okay

102
00:04:33,380 --> 00:04:30,930
to understand these why are the course

103
00:04:35,690 --> 00:04:33,390
topics going to be and then around those

104
00:04:37,850 --> 00:04:35,700
plan out the lessons activities this

105
00:04:40,100 --> 00:04:37,860
ensures that these lessons and

106
00:04:44,480 --> 00:04:40,110
activities are all going to be related

107
00:04:47,270 --> 00:04:44,490
back to this big idea more importantly

108
00:04:49,190 --> 00:04:47,280
perhaps is the way they build on one

109
00:04:51,590 --> 00:04:49,200
another this is the example of the

110
00:04:55,490 --> 00:04:51,600
storyline that I have been working on

111
00:04:58,160 --> 00:04:55,500
starting with the basic question of how

112
00:05:01,280 --> 00:04:58,170
do we know that exoplanets are common in

113
00:05:04,070 --> 00:05:01,290

the universe in our in our galaxy and so

114
00:05:06,530 --> 00:05:04,080
forth it all starts with our solar

115
00:05:10,670 --> 00:05:06,540
system of course we look at patterns in

116
00:05:12,620 --> 00:05:10,680
the solar system things like we have

117
00:05:15,370 --> 00:05:12,630
terrestrial plants that are close to the

118
00:05:19,450 --> 00:05:15,380
Sun gas and ice giants that are far away

119
00:05:21,530 --> 00:05:19,460
everything orbits in the same plane um

120
00:05:24,380 --> 00:05:21,540
everything is orbiting in pretty much

121
00:05:26,720 --> 00:05:24,390
the same direction and rotating in most

122
00:05:29,660 --> 00:05:26,730
of the same direction with like two odd

123
00:05:31,610 --> 00:05:29,670
cases there so it tells us that we

124
00:05:36,650 --> 00:05:31,620
formed out of you guessed it based on

125
00:05:39,200 --> 00:05:36,660
all the previous talks a disk and then

126
00:05:41,270 --> 00:05:39,210
what we won't need to look at is okay

127
00:05:42,620 --> 00:05:41,280
these we see these processes occurring

128
00:05:45,350 --> 00:05:42,630
in our solar system or we see the

129
00:05:47,870 --> 00:05:45,360
evidence for them now you look elsewhere

130
00:05:50,630 --> 00:05:47,880
and see okay it looks like these

131
00:05:54,590 --> 00:05:50,640
processes really are occurring in other

132
00:05:56,420 --> 00:05:54,600
star forming systems as well cool so we

133
00:05:57,500 --> 00:05:56,430
convicts we kind of expect exoplanets to

134
00:06:00,380 --> 00:05:57,510
be everywhere but we got to figure out

135
00:06:02,900 --> 00:06:00,390
how to find them once we figure out how

136
00:06:07,430 --> 00:06:02,910
to find them we find them and holy crud

137
00:06:09,350 --> 00:06:07,440
there are a lot of them so and there are

138
00:06:12,890 --> 00:06:09,360

a lot of very strange ones so we go into

139
00:06:14,710 --> 00:06:12,900
a bit beyond just plants are common how

140
00:06:18,140 --> 00:06:14,720
did the planets get to the way they are

141
00:06:20,540 --> 00:06:18,150
so we talk about the interactions that

142
00:06:22,010 --> 00:06:20,550
occur between the bodies and planetary

143
00:06:22,970 --> 00:06:22,020
systems because this leads some really

144
00:06:25,070 --> 00:06:22,980
cool stuff and it's actually very

145
00:06:28,970 --> 00:06:25,080
relevant for our solar system as well

146
00:06:30,260 --> 00:06:28,980
and of course we want to talk about the

147
00:06:32,510 --> 00:06:30,270
thing that everybody wants to know about

148
00:06:34,370 --> 00:06:32,520
exoplanets is there life on these

149
00:06:38,180 --> 00:06:34,380
planets potentially and how would we

150
00:06:39,830 --> 00:06:38,190
look for that but first I'm going to

151
00:06:40,580 --> 00:06:39,840
give you a just brief overview about

152
00:06:42,140 --> 00:06:40,590
what

153
00:06:45,920 --> 00:06:42,150
the next generation science standards

154
00:06:48,290 --> 00:06:45,930
are all about traditionally science

155
00:06:50,810 --> 00:06:48,300
standards have just focused on these

156
00:06:52,400 --> 00:06:50,820
content areas the disciplinary core

157
00:06:55,060 --> 00:06:52,410
ideas this is the content knowledge

158
00:06:57,410 --> 00:06:55,070
stuff what you normally think of for our

159
00:07:00,400 --> 00:06:57,420
standards what do the students have to

160
00:07:02,570 --> 00:07:00,410
know more or less like factually and

161
00:07:04,100 --> 00:07:02,580
separate into three main areas life

162
00:07:05,860 --> 00:07:04,110
sciences does go science is earth

163
00:07:08,150 --> 00:07:05,870

sciences okay cool

164
00:07:11,030 --> 00:07:08,160
the next two the science and engineering

165
00:07:12,950 --> 00:07:11,040
practices and the cross-cutting concepts

166
00:07:16,880 --> 00:07:12,960
are the parts that are completely new

167
00:07:19,280 --> 00:07:16,890
for next generation science standards I

168
00:07:23,120 --> 00:07:19,290
want to get the students an idea of how

169
00:07:25,610 --> 00:07:23,130
science is done on and so some examples

170
00:07:26,630 --> 00:07:25,620
these there are actually eight science

171
00:07:28,460 --> 00:07:26,640
and engineering practices they're

172
00:07:31,420 --> 00:07:28,470
listing the full document but these just

173
00:07:36,890 --> 00:07:31,430
some examples and the cross-cutting

174
00:07:39,710 --> 00:07:36,900
concepts then are not disciplinary core

175
00:07:41,270 --> 00:07:39,720
ideas these are not your typical you

176
00:07:43,280 --> 00:07:41,280
know students to know that like the

177
00:07:46,280 --> 00:07:43,290
earth goes around the Sun these are kind

178
00:07:49,150 --> 00:07:46,290
of threads and recurring themes that

179
00:07:52,820 --> 00:07:49,160
connect your disciplinary core ideas

180
00:07:55,460 --> 00:07:52,830
across the various levels things like

181
00:07:57,980 --> 00:07:55,470
ideas about energy and matter and

182
00:08:00,830 --> 00:07:57,990
stability change in patterns and things

183
00:08:02,830 --> 00:08:00,840
like that so now you're all experts on

184
00:08:09,550 --> 00:08:02,840
the next generation science standards

185
00:08:13,780 --> 00:08:09,560
how do exoplanets fit into and GSS well

186
00:08:16,070 --> 00:08:13,790
unfortunately not strictly speaking

187
00:08:17,930 --> 00:08:16,080
because of course exoplanets are an

188
00:08:20,770 --> 00:08:17,940

incredibly new field that really haven't

189
00:08:22,940 --> 00:08:20,780
made their way into curricula below like

190
00:08:26,480 --> 00:08:22,950
introductory level astronomy at the

191
00:08:29,450 --> 00:08:26,490
college level so why should teachers

192
00:08:32,360 --> 00:08:29,460
care about that main thing to note is

193
00:08:35,120 --> 00:08:32,370
that standards are not necessarily a

194
00:08:39,340 --> 00:08:35,130
list of the ways in which you should

195
00:08:43,010 --> 00:08:39,350
teach your students something instead

196
00:08:44,900 --> 00:08:43,020
using exoplanets to talk about these in

197
00:08:47,960 --> 00:08:44,910
this case the disciplinary core ideas

198
00:08:50,360 --> 00:08:47,970
that I've listed here provides another

199
00:08:52,880 --> 00:08:50,370
context looking at them entirely and

200
00:08:53,930 --> 00:08:52,890
connects them in completely different

201
00:08:56,560 --> 00:08:53,940
ways than you

202
00:09:01,600 --> 00:08:56,570
would see just by following you know the

203
00:09:09,260 --> 00:09:05,530
secondly I'm referring to the

204
00:09:11,810 --> 00:09:09,270
cross-cutting concepts the two that I

205
00:09:14,060 --> 00:09:11,820
focused on the most in developing the

206
00:09:15,850 --> 00:09:14,070
curriculum for aster 850 were patterns

207
00:09:18,530 --> 00:09:15,860
and ideas of stability and change

208
00:09:21,320 --> 00:09:18,540
patterns are incredibly important to our

209
00:09:23,120 --> 00:09:21,330
detection of exoplanets because as you

210
00:09:25,790 --> 00:09:23,130
can see in like this sample light curve

211
00:09:27,950 --> 00:09:25,800
you're looking for a pattern a recurring

212
00:09:29,870 --> 00:09:27,960
decrease in the brightness of a star

213
00:09:31,910 --> 00:09:29,880

that indicates that there is they plant

214
00:09:33,170 --> 00:09:31,920
it transiting in front of it of course

215
00:09:34,580 --> 00:09:33,180
there's a little bit more work to figure

216
00:09:36,140 --> 00:09:34,590
out that's actually your planet and all

217
00:09:38,930 --> 00:09:36,150
but I'll leave that up to the people

218
00:09:43,250 --> 00:09:38,940
with the really fancy radial velocity

219
00:09:45,470 --> 00:09:43,260
instruments and stability and change so

220
00:09:47,750 --> 00:09:45,480
while our solar system now is very

221
00:09:50,210 --> 00:09:47,760
stable and everything is pretty much set

222
00:09:53,930 --> 00:09:50,220
in its orbit it wasn't always the case

223
00:09:58,640 --> 00:09:53,940
on the nice model which is illustrated

224
00:10:05,000 --> 00:09:58,650
here basically demonstrates that about

225
00:10:07,400 --> 00:10:05,010
what was it a few a few hundreds of

226
00:10:10,220 --> 00:10:07,410
millions of years into the formation of

227
00:10:13,610 --> 00:10:10,230
the solar system things went completely

228
00:10:15,050 --> 00:10:13,620
haywire um Uranus went from being the

229
00:10:17,900 --> 00:10:15,060
eighth planet orbiting the Sun to the

230
00:10:19,760 --> 00:10:17,910
seventh and kicked out a whole bunch of

231
00:10:23,210 --> 00:10:19,770
comets and things like that

232
00:10:24,560 --> 00:10:23,220
essentially planetary leftovers that

233
00:10:28,700 --> 00:10:24,570
eventually went on to form the Oort

234
00:10:31,420 --> 00:10:28,710
cloud and this also change where the

235
00:10:34,100 --> 00:10:31,430
orbits of the planets were it could have

236
00:10:35,870 --> 00:10:34,110
completely different consequences in

237
00:10:38,660 --> 00:10:35,880
terms of these shapes of the orbits but

238
00:10:42,320 --> 00:10:38,670

in our case most the orbits actually

239
00:10:44,210 --> 00:10:42,330
turned out to be fairly circular and the

240
00:10:46,130 --> 00:10:44,220
claims evidence reasoning framework the

241
00:10:48,790 --> 00:10:46,140
way that we are developing all the

242
00:10:50,660 --> 00:10:48,800
activities are really I am admittedly

243
00:10:54,220 --> 00:10:50,670
developing the activities for this

244
00:10:57,890 --> 00:10:54,230
course is a way that students can engage

245
00:11:00,230 --> 00:10:57,900
with actual like data or observations

246
00:11:02,720 --> 00:11:00,240
the example I'm showing here is this

247
00:11:05,570 --> 00:11:02,730
little web game called super planet

248
00:11:07,519 --> 00:11:05,580
crash if you haven't heard of it check

249
00:11:10,540 --> 00:11:07,529
it out it's addictively fun

250
00:11:14,960 --> 00:11:10,550
but what I have the students do here is

251
00:11:16,939 --> 00:11:14,970
you have planets orbiting this star you

252
00:11:18,949 --> 00:11:16,949
can adjust the mass of the inserted

253
00:11:20,929 --> 00:11:18,959
planet and you get a higher score when

254
00:11:23,920 --> 00:11:20,939
you use more massive objects but

255
00:11:27,610 --> 00:11:23,930
throwing a lot of massive objects into a

256
00:11:29,960 --> 00:11:27,620
you know to AU distance from a star

257
00:11:35,869 --> 00:11:29,970
obviously makes things go a little

258
00:11:38,360 --> 00:11:35,879
unstable so the goal here for this game

259
00:11:40,489 --> 00:11:38,370
is to try to create a stable system and

260
00:11:43,009 --> 00:11:40,499
what I have the students do is play

261
00:11:45,650 --> 00:11:43,019
around with this and look at what our

262
00:11:49,249 --> 00:11:45,660
the conditions that you're developing or

263
00:11:51,410 --> 00:11:49,259

your observing for stability in these

264
00:11:56,840 --> 00:11:51,420
systems and why is that going to be the

265
00:11:59,299 --> 00:11:56,850
case now on to the very last part the

266
00:12:01,480 --> 00:11:59,309
dealing with these kinds of activities

267
00:12:05,509 --> 00:12:01,490
in an online setting

268
00:12:08,119 --> 00:12:05,519
traditionally um students will write up

269
00:12:10,579 --> 00:12:08,129
claims evidence and reasoning and your

270
00:12:12,230 --> 00:12:10,589
group and present that to the class

271
00:12:14,389 --> 00:12:12,240
generally they'll write it on a

272
00:12:17,720 --> 00:12:14,399
whiteboard the term that's used in a lot

273
00:12:20,059 --> 00:12:17,730
of papers is the board meeting but the

274
00:12:22,429 --> 00:12:20,069
write up on a whiteboard and they talk

275
00:12:25,819 --> 00:12:22,439
about you know this is what we observe

276
00:12:28,610 --> 00:12:25,829
this is what we found and they get

277
00:12:32,019 --> 00:12:28,620
critique on it from other students this

278
00:12:35,720 --> 00:12:32,029
is scientific argumentation in practice

279
00:12:37,610 --> 00:12:35,730
moving the discussions online of course

280
00:12:40,549 --> 00:12:37,620
changes a lot of this because you don't

281
00:12:44,900 --> 00:12:40,559
have the face-to-face interactions and

282
00:12:48,769 --> 00:12:44,910
you have to switch to a more written

283
00:12:50,480 --> 00:12:48,779
style of critique argumentation then you

284
00:12:52,790 --> 00:12:50,490
would have in a normal face-to-face

285
00:12:54,590 --> 00:12:52,800
class which is usually where claims

286
00:12:58,160 --> 00:12:54,600
evidence reasoning type activities are

287
00:13:00,740 --> 00:12:58,170
used one interesting thing that this

288
00:13:04,249 --> 00:13:00,750

does though is as I noticed it gives you

289
00:13:06,679 --> 00:13:04,259
a window into the thinking of the

290
00:13:10,850 --> 00:13:06,689
students that are making the arguments

291
00:13:14,269 --> 00:13:10,860
both in terms of presenting what they

292
00:13:15,829 --> 00:13:14,279
determined and students who are maybe

293
00:13:19,220 --> 00:13:15,839
arguing against the way that they

294
00:13:20,770 --> 00:13:19,230
grouped you know the gas and ice giants

295
00:13:23,780 --> 00:13:20,780
separately

296
00:13:27,470 --> 00:13:23,790
the last thing of course is deadlines

297
00:13:30,290 --> 00:13:27,480
because this is not face to face you

298
00:13:35,150 --> 00:13:30,300
need to make sure that students have you

299
00:13:39,740 --> 00:13:35,160
know provide feedback on the your other

300
00:13:41,630 --> 00:13:39,750
students work by this time because then

301
00:13:46,850 --> 00:13:41,640
the students need to be able to respond

302
00:13:49,970 --> 00:13:46,860
to the critiques of their work so I'll

303
00:13:52,930 --> 00:13:49,980
leave my summary slide up here and I

304
00:14:03,080 --> 00:13:52,940
will take questions at this time thank

305
00:14:10,140 --> 00:14:06,300
so Danny you mentioned that exoplanets

306
00:14:13,410 --> 00:14:10,150
don't fit into the NGSS system strand Li

307
00:14:16,410 --> 00:14:13,420
speak strictly speaking and so are you

308
00:14:18,570 --> 00:14:16,420
envisioning that instructors will go out

309
00:14:20,040 --> 00:14:18,580
of their way to sort of convolute the

310
00:14:21,690 --> 00:14:20,050
system so that they can talk about

311
00:14:25,440 --> 00:14:21,700
exoplanets in particular or are you

312
00:14:27,720 --> 00:14:25,450
using it as sort of a where in the

313
00:14:30,090 --> 00:14:27,730

curriculum do you see exoplanets fitting

314
00:14:33,690 --> 00:14:30,100
I see it as a way to grab students

315
00:14:36,480 --> 00:14:33,700
attention frankly um let's face it

316
00:14:38,910 --> 00:14:36,490
exoplanets are really cool they're one

317
00:14:40,770 --> 00:14:38,920
of the most interesting fields right now

318
00:14:43,350 --> 00:14:40,780
because it's growing incredibly fast and

319
00:14:45,360 --> 00:14:43,360
planets unlike a whole lot of the other

320
00:14:47,790 --> 00:14:45,370
stuff in astronomy is something that we

321
00:14:51,110 --> 00:14:47,800
can relate to very directly being on a

322
00:14:53,730 --> 00:14:51,120
planet ourselves so thinking about that

323
00:14:56,400 --> 00:14:53,740
there are other planets out there what

324
00:14:58,680 --> 00:14:56,410
about other planets with life out there

325
00:15:01,950 --> 00:14:58,690
is just one of the most fundamental

326
00:15:06,030 --> 00:15:01,960
questions of our existence and you can

327
00:15:07,950 --> 00:15:06,040
bring that into a classroom context just

328
00:15:10,100 --> 00:15:07,960
on the fact that students can find it

329
00:15:13,100 --> 00:15:10,110
more interesting than maybe you know

330
00:15:15,900 --> 00:15:13,110
rehashing the same things about Earth

331
00:15:17,910 --> 00:15:15,910
but they give you opportunity to sound

332
00:15:20,750 --> 00:15:17,920
all of those same disciplinary core

333
00:15:23,820 --> 00:15:20,760
ideas you would be hitting otherwise um

334
00:15:31,990 --> 00:15:23,830
just doing it with a slightly different

335
00:15:43,760 --> 00:15:41,510
one in the back Bradley alright so

336
00:15:46,070 --> 00:15:43,770
piggybacking on that question so are you

337
00:15:48,020 --> 00:15:46,080
envisioning this as a semester kind of

338
00:15:49,990 --> 00:15:48,030

course or is it going to be something

339
00:15:53,660 --> 00:15:50,000
that you would you know plug in into

340
00:15:55,700 --> 00:15:53,670
certain classes like patterns you know

341
00:15:57,710 --> 00:15:55,710
you put it into a physics class and the

342
00:16:01,640 --> 00:15:57,720
chapter and you know you give a case

343
00:16:04,040 --> 00:16:01,650
study almost okay so a350 itself is on a

344
00:16:06,350 --> 00:16:04,050
course on its own but the idea of the

345
00:16:09,440 --> 00:16:06,360
activities is that they can kind of slot

346
00:16:12,260 --> 00:16:09,450
into a course individually these are

347
00:16:14,090 --> 00:16:12,270
things that really we want teachers to

348
00:16:15,530 --> 00:16:14,100
be able to take into their own

349
00:16:18,200 --> 00:16:15,540
classrooms which is why it's so

350
00:16:20,840 --> 00:16:18,210
important that they're NGSS aligned in

351
00:16:23,240 --> 00:16:20,850
things like that ideally it would be

352
00:16:26,510 --> 00:16:23,250
kind of a curriculum unit that you do

353
00:16:28,820 --> 00:16:26,520
all together you know in sequence so

354
00:16:31,160 --> 00:16:28,830
you're not breaking up this you know

355
00:16:34,310 --> 00:16:31,170
coherent content storyline that I've put

356
00:16:36,440 --> 00:16:34,320
together but really if you just want to

357
00:16:39,620 --> 00:16:36,450
you know take out a particular part of

358
00:16:49,760 --> 00:16:39,630
this and use it by all means that's

359
00:16:52,370 --> 00:16:49,770
totally fine with me so this can

360
00:16:54,860 --> 00:16:52,380
coherent content storyline can this be

361
00:16:57,560 --> 00:16:54,870
scaled down to a single lecture for

362
00:17:00,200 --> 00:16:57,570
someone who's like a TA for a larger

363
00:17:02,120 --> 00:17:00,210

course who needs to stay on a stricter

364
00:17:04,640 --> 00:17:02,130
schedule could they incorporate some of

365
00:17:08,870 --> 00:17:04,650
these ideas to you know enhance their

366
00:17:14,420 --> 00:17:08,880
own lectures I'm not going to say no to

367
00:17:16,340 --> 00:17:14,430
that so the main thing to take away from

368
00:17:19,850 --> 00:17:16,350
that if you're scaling it down to you

369
00:17:24,500 --> 00:17:19,860
know a single classes worth of material

370
00:17:26,050 --> 00:17:24,510
is to come up with what do you want

371
00:17:29,600 --> 00:17:26,060
students to get out of this particular

372
00:17:31,340 --> 00:17:29,610
you know lecture activity or lecture

373
00:17:33,770 --> 00:17:31,350
plus activity whatever it happens to be

374
00:17:35,930 --> 00:17:33,780
and make sure you're playing around that

375
00:17:36,620 --> 00:17:35,940
with that in mind throughout the entire

376
00:17:40,360 --> 00:17:36,630
process

377
00:17:43,640 --> 00:17:40,370
um spell out what those connections are

378
00:17:44,630 --> 00:17:43,650
it's not like the your learning goal is

379
00:17:47,050 --> 00:17:44,640
some

380
00:17:49,310 --> 00:17:47,060
thing that the students never get to see

381
00:17:50,870 --> 00:17:49,320
ideally they should know exactly what

382
00:17:53,870 --> 00:17:50,880
they're working towards the entire time

383
00:17:57,260 --> 00:17:53,880
that's what you start with actually day

384
00:17:59,570 --> 00:17:57,270
one of a class for a straight fifty

385
00:18:02,480 --> 00:17:59,580
students will be introduced to like the

386
00:18:04,940 --> 00:18:02,490
Keppler or e because it shows a lot of

387
00:18:06,920 --> 00:18:04,950
planets and the diversity of the systems

388
00:18:08,540 --> 00:18:06,930

that Kepler is found of course it's not

389
00:18:11,300 --> 00:18:08,550
complete because we found planets other

390
00:18:15,580 --> 00:18:11,310
ways but they'll get all of these as

391
00:18:18,410 --> 00:18:15,590
caveats as well um but scaling it down

392
00:18:20,450 --> 00:18:18,420
I'd say works on that level just make

393
00:18:29,950 --> 00:18:20,460
sure that things are consistent and