

Curiosity and interest in the moment: Their networks and demarcations

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Introduction

Curiosity, the human drive for learning, is gaining increasing attention in the field of education and psychology (e.g., Vogl, Pekrun, Murayama, & Loderer, 2018). However, the demarcation problem between curiosity and interest is creating intensive discussion (Grossnickle, 2016; Renninger & Hidi, 2016) and needs to be addressed adequately in order to move the field forward. Is curiosity synonymous with interest (Silvia, 2008), or do they have some crucial differences (Renninger & Hidi, 2016)? Answering these questions is important as it not only helps us avoid the jingle-jangle fallacy that has often been the case in education and psychology, but clarifying the boundary between curiosity and interest can also have specific implications for researchers and educators. To solve this problem, we need studies that examine these two concepts at the situational level (i.e., using the experience sampling method; ESM). By measuring variables multiple times over a short period of time (e.g., 5–6 times per day over two weeks), ESM provides us not only with a snapshot of variables in the moment but also a more reliable way with which to measure the variables (Berkel, Ferreira, & Kostakos, 2017; Hektner, Schmidt, & Csikszentmihalyi, 2007). Moreover, the data analytical method should also go beyond the conventional analysis such as multi-level modeling that has been used in previous studies.

The purpose of this study was to examine the differences between curiosity and interest using network analysis (i.e., co-occurrence analysis) based on ESM data. By showing how differently curiosity and interest relate to other academic emotions and motivations, and comparing the differences between curiosity networks and interest networks, we were able to determine the extent to which and the aspect from which curiosity is distinct from interest.

Method

Samples and measures

The sample in this study consisted of 59 first-year high school students from four classes in three schools in Helsinki, Finland. The data were collected in the fall of 2017 as part of a larger international study that focused on science learning. The data on situational emotions and motivations were obtained via ESM questionnaires delivered via smartphones. The phones were programmed to signal the students randomly 3–4 times per day (at least once when they had science lessons) over a period of two weeks. In total, the data comprised 1704 responses/situations (average response per person was 28.88).

In this study, the students were signaled to answer an ESM questionnaire in which they first had to indicate what kinds of activities (e.g., listening, discussion) they were doing. Then they were asked to report their academic emotions and motivations when they received the alert. Examples of the questions used are: Do you feel curious? How well did you focus (concentrate)? Did you manage

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your work (control)? Did your performance meet the expectations of others (other-expect)? I studied and examined what I did (examination). A full list of items can be found in the appendix. All the items were rated on a scale of 1 (not at all) to 4 (very much).

Data analysis approach

This study conducted two types of network analysis. The first was the co-occurrence network analysis and the second, in a supplementary way, was the correlation-based network analysis. The co-occurrence network analysis, according to Moeller et al. (2018), can show how often (or rarely) two variables co-occur at high levels. The strengths of the co-occurrence network analysis compared to the correlation-based network analysis are twofold. First, co-occurrence analysis avoids misinterpretation of correlations. Typically, when interpreting high positive correlations between two variables (e.g., A & B), researchers conclude that variable A is “high” when variable B is “high”, even though in the reality both A and B might be rated at a low level on the original scale. Because correlations mean how consistently the ratings of two variables are aligned, how these two variables occur together at a high level is not necessarily revealed. Second, frequent co-occurrence may occur even when two variables correlate negatively, which could only be detected using co-occurrence analysis. In this study, to perform co-occurrence analysis, we dichotomized situational emotions and motivations at the scale midpoint.

Preliminary findings

Table 1 and 2 show the networks of interest and curiosity, respectively. A relative index of edge weight was calculated for both interest and curiosity. The results concerning the interest network (see Table 1) showed that, in total, high-level interest occurred 1204 times. When interest occurred, feelings of enjoyment (edge=1029; 85.47%), control (edge=1016; 84.39%), success (edge=957; 79.49%), importance to self (edge=954; 79.24%) and concentration (edge=948; 78.74%) were the top five co-occurring motivations. Curiosity (edge=658; 54.65%) only occurred at a probability of 0.54.

However, when curiosity occurred (self-edge=741; see Table 2), feelings of interest (edge=658; 88.8%), control (edge=637; 85.96%), enjoyment (edge=631; 85.16%), inquisitiveness (edge=621; 83.81%), and meeting self-expectations (edge=612; 82.59%) typically occurred at the same time.

The correlation-based network analysis (See Table 1&2 and Figure 2a&2b) showed that interest was closer to enjoyment, happiness, feelings of being skilled and concentration, whereas curiosity was closer to feelings of inquisitiveness, wanting to know more and behaviors of question-asking, exploring and examination.

Discussion

The findings show that when students reported high interest, they only felt curious half of the time, but when they reported high curiosity, they were high likely to report interest at the same time. Further findings show that curiosity, in comparison to interest, is closer to feelings of inquisitiveness and behaviors of question-asking and exploring. In summary, curiosity may be part of interest, particularly in terms of knowledge-striving part, but not necessarily in terms of happiness part.

The network analysis (i.e., both co-occurrence and correlation-based analysis) used in this study has important implications for intensive data studies. First, it visualizes the strength of relationships between a set of variables. The relationships in an intensive dataset are more reliable than those in a

dataset measuring the variables only once per year or once per six months. Second, the use of co-occurrence analysis in addition to correlation-based analysis provides us with a more comprehensive picture of the relationships of variables. Third, the comparison of multiple networks helps us better understand the differences between variables and avoid the jingle-jangle fallacy that often occurs in the field of education and psychology.

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Table 1. Co-occurrences of Interest-emotion and motivation pairs in the experience sampling method data

| Rank | Node1 | Node2 | Edge weight | % of all edges | % of Interest edges ¹ as reference | Situational-level correlation | Person-level correlation |
|------|----------|--------------------|-------------|----------------|---|-------------------------------|--------------------------|
| | Interest | <i>Emotions</i> | | | | | |
| 19 | | curious | 658 | 2.86% | 54.65% | 0.38* | 0.37* |
| 8 | | happy | 896 | 3.89% | 74.42% | 0.47* | 0.52* |
| 11 | | excited | 747 | 3.24% | 62.04% | 0.51* | 0.61* |
| 34 | | anxious | 176 | 0.76% | 14.62% | -0.23* | -0.07 |
| 30 | | competitive | 275 | 1.19% | 22.84% | 0.14* | 0.25 |
| 36 | | lonely | 142 | 0.62% | 11.79% | -0.11* | -0.26 |
| 29 | | stress | 318 | 1.38% | 26.41% | -0.15* | -0.06 |
| 25 | | proud | 429 | 1.86% | 35.63% | 0.26* | 0.31* |
| 14 | | cooperative | 733 | 3.18% | 60.88% | 0.19* | 0.43* |
| 33 | | bored | 225 | 0.98% | 18.69% | -0.48* | -0.28* |
| 10 | | confident | 756 | 3.28% | 62.79% | 0.29* | 0.48* |
| 32 | | confused | 226 | 0.98% | 18.77% | -0.09* | -0.09 |
| 20 | | active | 648 | 2.81% | 53.82% | 0.34* | 0.51* |
| 12 | | inquisitive | 746 | 3.24% | 61.96% | 0.34* | 0.52* |
| | | <i>Motivations</i> | | | | | |
| 7 | | skill | 902 | 3.92% | 74.92% | 0.44* | 0.60* |
| 24 | | challenge | 473 | 2.05% | 39.29% | 0.06* | 0.18 |
| 35 | | giveup | 163 | 0.71% | 13.54% | -0.30* | 0.03 |
| 5 | | concentrate | 948 | 4.11% | 78.74% | 0.52* | 0.72* |
| 1 | | enjoy | 1029 | 4.47% | 85.47% | 0.66* | 0.79* |
| 2 | | control | 1016 | 4.41% | 84.39% | 0.33* | 0.64* |
| 3 | | success | 957 | 4.15% | 79.49% | 0.39* | 0.70* |
| 4 | | importantyou | 954 | 4.14% | 79.24% | 0.51* | 0.74* |
| 17 | | importantfuture | 692 | 3.00% | 57.48% | 0.18* | 0.48* |
| 9 | | otherexpect | 867 | 3.76% | 72.01% | 0.20* | 0.34* |
| 6 | | selfexpect | 937 | 4.07% | 77.82% | 0.31* | 0.46* |
| 13 | | time | 745 | 3.23% | 61.88% | 0.46* | 0.42* |
| 15 | | grit | 730 | 3.17% | 60.63% | 0.38* | 0.60* |
| 22 | | effort | 542 | 2.35% | 45.02% | 0.24* | 0.48* |
| 23 | | imagination | 513 | 2.23% | 42.61% | 0.26* | 0.31* |
| 27 | | solutions | 393 | 1.71% | 32.64% | 0.16* | 0.14 |
| 26 | | exploring | 427 | 1.85% | 35.47% | 0.14* | 0.17 |
| 21 | | ideas | 554 | 2.40% | 46.01% | 0.27* | 0.30* |
| 31 | | context | 254 | 1.10% | 21.10% | 0.10* | 0.23 |
| 28 | | questions | 378 | 1.64% | 31.40% | 0.17* | 0.30* |
| 16 | | knowmore | 704 | 3.06% | 58.47% | 0.39* | 0.41* |
| 18 | | examination | 682 | 2.96% | 56.64% | 0.21* | 0.41* |

Note. ¹Number of Interest self-edges is 1204

Table 2. Co-occurrences of Curious-emotion and motivation pairs in the experience sampling method data

| Rank | Node1 | Node2 | Edge weight | % of all edges | % of Curious edges ¹ as reference | Situational-level correlation | Person-level correlation |
|------|---------|--------------------|-------------|----------------|--|-------------------------------|--------------------------|
| | Curious | <i>Emotions</i> | | | | | |
| 1 | | interest | 658 | 4.15% | 88.80% | 0.38* | 0.37* |
| 6 | | happy | 602 | 3.79% | 81.24% | 0.34* | 0.56* |
| 15 | | excited | 529 | 3.33% | 71.39% | 0.43* | 0.66* |
| 33 | | anxious | 124 | 0.78% | 16.73% | -0.07* | -0.06 |
| 29 | | competitive | 215 | 1.35% | 29.01% | 0.20* | 0.44* |
| 36 | | lonely | 85 | 0.54% | 11.47% | -0.08* | -0.32* |
| 31 | | stress | 185 | 1.17% | 24.97% | -0.08* | -0.13 |
| 24 | | proud | 347 | 2.19% | 46.83% | 0.33* | 0.62* |
| 10 | | cooperative | 560 | 3.53% | 75.57% | 0.33* | 0.80* |
| 34 | | bored | 118 | 0.74% | 15.92% | -0.30* | -0.36* |
| 14 | | confident | 538 | 3.39% | 72.60% | 0.25* | 0.69* |
| 32 | | confused | 175 | 1.10% | 23.62% | 0.13* | 0.18 |
| 16 | | active | 512 | 3.23% | 69.10% | 0.44* | 0.76* |
| 4 | | inquisitive | 621 | 3.91% | 83.81% | 0.61* | 0.90* |
| | | <i>Motivations</i> | | | | | |
| 11 | | skill | 558 | 3.52% | 75.30% | 0.16* | 0.37* |
| 25 | | challenge | 311 | 1.96% | 41.97% | 0.12* | 0.12 |
| 35 | | giveup | 102 | 0.64% | 13.77% | -0.11* | -0.20 |
| 9 | | concentrate | 588 | 3.70% | 79.35% | 0.31* | 0.34* |
| 3 | | enjoy | 631 | 3.98% | 85.16% | 0.32* | 0.52* |
| 2 | | control | 637 | 4.01% | 85.96% | 0.16* | 0.33* |
| 8 | | success | 596 | 3.75% | 80.43% | 0.18* | 0.36* |
| 7 | | importantyou | 599 | 3.77% | 80.84% | 0.29* | 0.38* |
| 20 | | importantfuture | 443 | 2.79% | 59.78% | 0.19* | 0.38* |
| 12 | | otherexpect | 556 | 3.50% | 75.03% | 0.18* | 0.49* |
| 5 | | selfexpect | 612 | 3.86% | 82.59% | 0.22* | 0.40* |
| 19 | | time | 467 | 2.94% | 63.02% | 0.25* | 0.38* |
| 17 | | grit | 501 | 3.16% | 67.61% | 0.29* | 0.55* |
| 22 | | effort | 369 | 2.32% | 49.80% | 0.23* | 0.63* |
| 23 | | imagination | 355 | 2.24% | 47.91% | 0.27* | 0.50* |
| 28 | | solutions | 268 | 1.69% | 36.17% | 0.18* | 0.36* |
| 26 | | exploring | 310 | 1.95% | 41.84% | 0.19* | 0.50* |
| 21 | | ideas | 411 | 2.59% | 55.47% | 0.33* | 0.58* |
| 30 | | context | 202 | 1.27% | 27.26% | 0.22* | 0.50* |
| 27 | | questions | 296 | 1.86% | 39.95% | 0.29* | 0.62* |
| 13 | | knowmore | 555 | 3.50% | 74.90% | 0.51* | 0.78* |
| 18 | | examination | 496 | 3.12% | 66.94% | 0.36* | 0.68* |

Note. ¹Number of Curious self-edges is 741

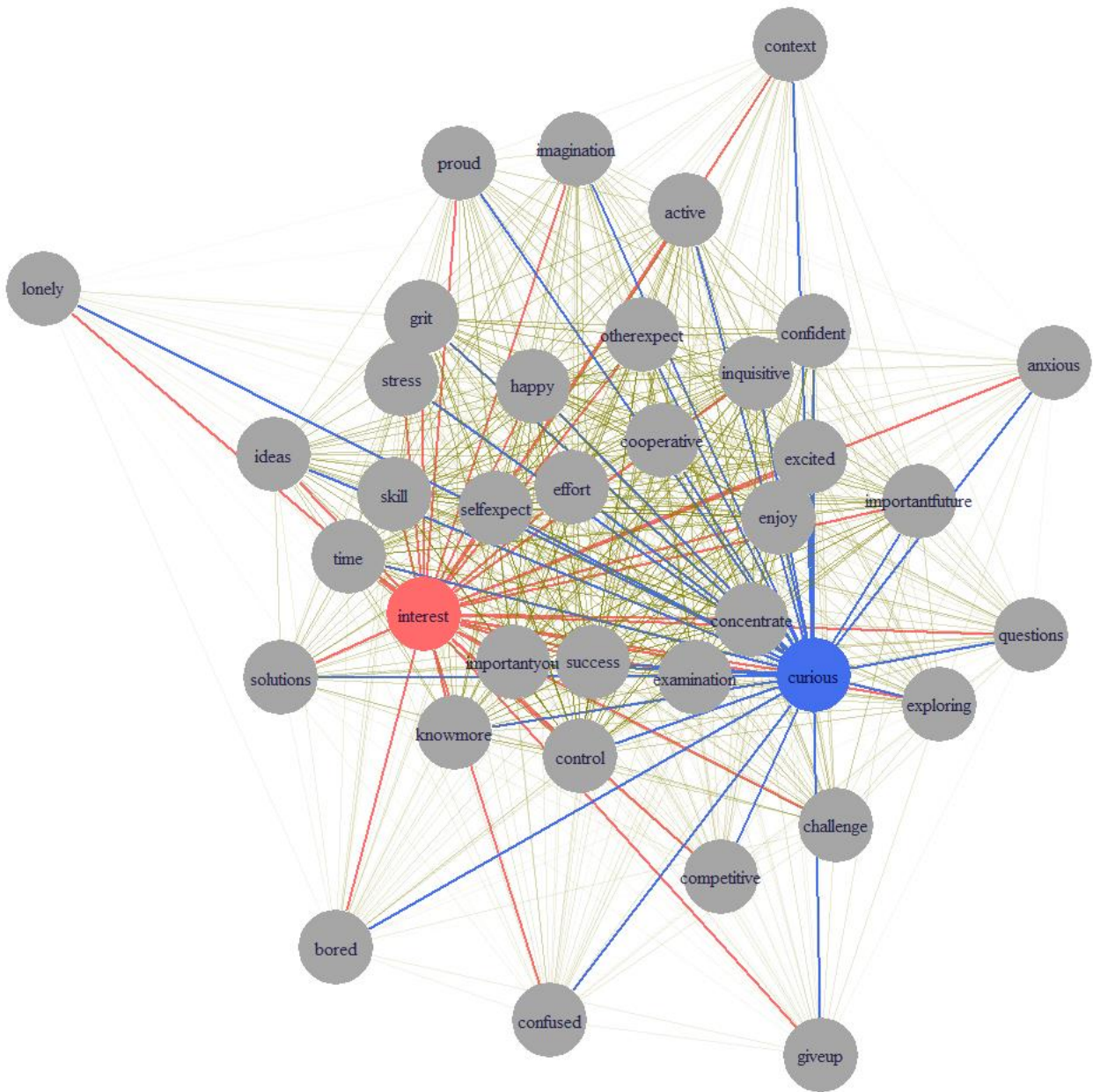


Figure1. Networks between variables based on co-occurrences frequencies

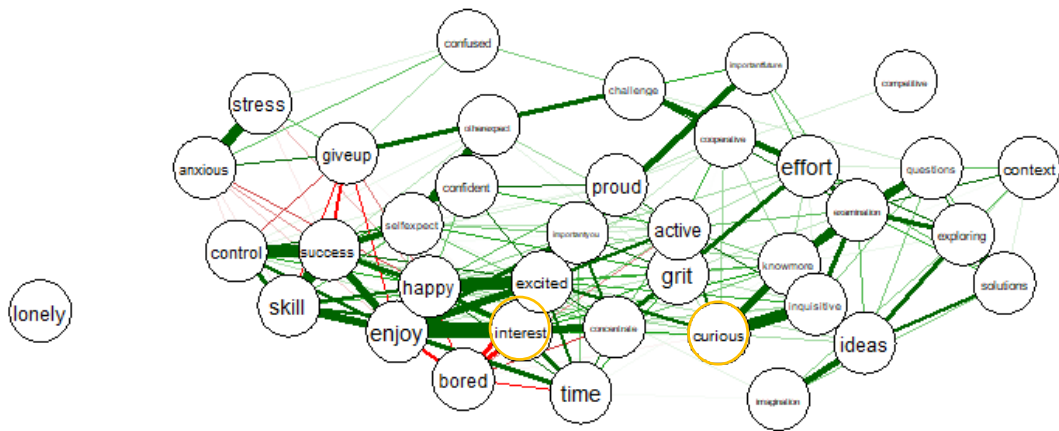


Figure2a. Networks between variables based on within-level correlations

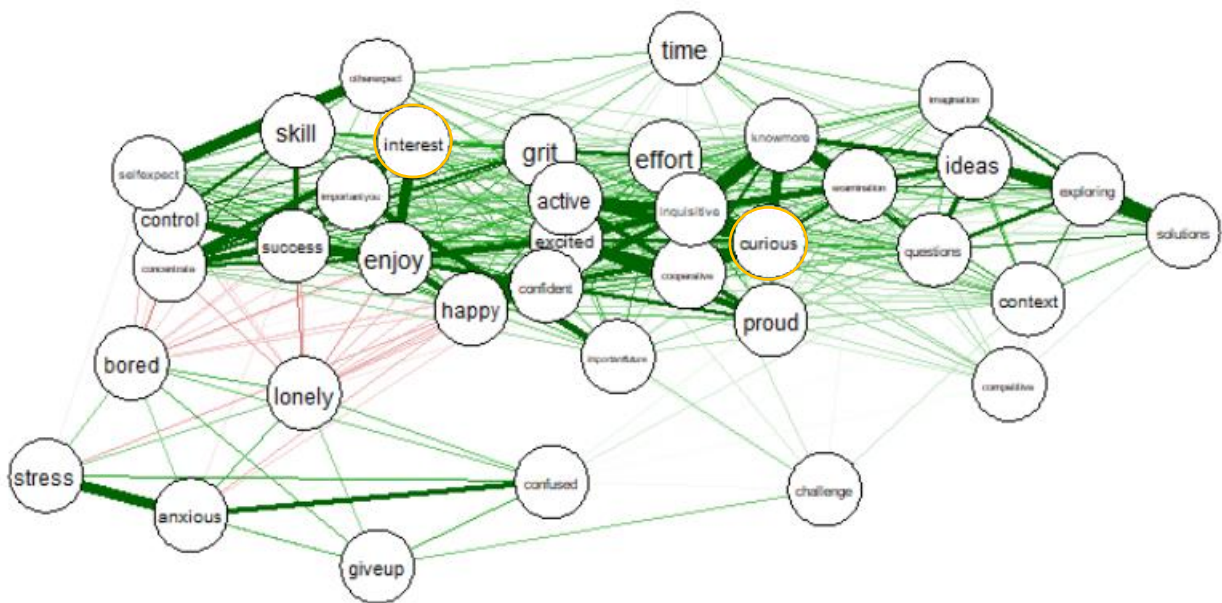


Figure 2b. Networks between variables based on between-level correlations

Appendix

Emotions and motivations items measured in the study

What do you feel and think about the activity you did (1 Not at all 4 Very Much)

- Do you feel happy?
- Do you feel excited?
- Do you feel anxious?
- Do you feel competitive?
- Do you feel lonely?
- Do you feel stress?
- Do you feel proud?
- Do you feel cooperative?
- Do you feel bored?
- Do you feel confident?
- Do you feel confused?
- Do you feel active?
- Do you feel frustrated?
- Do you feel curious?
- Do you feel inquisitive?
- Are you interested in what you did? (interest)
- Did you feel skilled in what you did? (skill)
- Was your work challenging? (challenge)
- Did you feel that you wanted to give up? (giveup)
- How well did you focus? (concentrate)
- Did you like what you did? (enjoy)
- Did you manage your work? (control)
- Did you succeed? (success)
- Was it what you did important to you? (importantyou)
- Was it what you did important for your future? (importantfuture)
- Did your performance meet the expectations of others? (otherexpect)
- Did you do follow your own expectations? (selfexpect)
- Were you immersed in what you did not notice the passage of time? (time)
- How persistent are you while working? (grit)
- How many efforts did you put when working? (effort)
- While working... I used my imagination (imagination)
- While working... solving problems with multiple answers (solutions)
- While working... I tried different solutions for exploring (exploring)
- While working got new ideas (ideas)
- While working... I combined the contents of different subjects in context (context)
- When I was working... I asked a lot of questions (questions)
- While working... I wanted to know more/do more (knowmore)
- While I was working ... I studied and examined what I did (examination)