Using Science Fiction with School Librarians to Interest and Engage Middle Schoolers in STEM Activities and Topics

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Science Fiction is STEM

Seven areas frequently found in SF (Luokkala, 2014) offer a manageable framework to examine student interests and find potential entry points into student contexts, with augmented subject suggestions:

- Nature of space and time (Astronomy, Physics, History of Science, Gravitation)
- Composition of the Universe (Geology, Matter, Light, Energy)
- Machine consciousness (HCI, Artificial Intelligence)
- Aliens (Anatomy, Biology, Zoology)
- The meaning of being human (Scientific method/Taxonomy, Ethics, Values)
- Solving future problems (Hydrology, Meteorology, Technology)
- What does the future hold? (Computer Science, Genetics, Astronautics) (Luokkala, 2014)
SF is Chock Full o’ YA Protagonists

• The “bright kid” is very recognizable and authentic to students and authors; many see themselves in that way

• The Bildungsroman archetype

• Heroic journey (think *Star Wars*)
SF is Highly Teachable and Has Been Used Successfully for Many Years

- Science of Star Wars; Physics of Star Trek
- Social Problem Solving, e.g. stranded on an alien world
- Multiple media formats can be incorporated with student choice
- STEM ethics can be introduced
- SF is more effective at generating STEM interest than other genres (Burton, Goldsmith, & Mattei, 2018)
School Librarian’s Role in STEM Education

• Captain of the research team making unique contributions to YA education (Subramaniam, et al, 2015)
• Librarians build on students’ existing heuristics, aligning with their natural information-wielding behaviors (Subramaniam, et al, 2015, “Simple”)
• Narrowing the socioeconomic digital divide
• Great teaching is needed more now than ever (Kimmel & Pasquini, 2018)
• Connected learning is ideal for STEM education; blends formal & informal
• No educator should be an island (Meyer, 2017)
Guided Inquiry

Arrows indicate collaboration opportunities
<table>
<thead>
<tr>
<th>Definition</th>
<th>Less-Developed (Earlier)</th>
<th>More-Developed (Later)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1: Triggered Situational Interest</td>
<td>Psychological state resulting from short-term changes in cognitive and affective processing associated with a particular class of content</td>
<td>Psychological state and the beginning of relatively enduring predisposition to seek reengagement with a particular class of content over time</td>
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<tr>
<td>Attends to content, if only fleetingly</td>
<td>Reengages content that previously triggered attention</td>
<td>Is likely to independently reengage content</td>
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<tr>
<td>May or may not be reflectively aware of the experience</td>
<td>Is developing knowledge of the content</td>
<td>Has stored knowledge and stored value</td>
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<tr>
<td>May experience either positive or negative feelings</td>
<td>Is developing a sense of the content's value</td>
<td>Is reflective about the content</td>
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<td></td>
<td>Is likely to be supported by others to find connections to content based on existing skills, knowledge, and/or prior experience</td>
<td>Is focused on their own questions</td>
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<tr>
<td></td>
<td>Is likely to have positive feelings</td>
<td>Has positive feelings</td>
</tr>
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Hidi & Renninger, 2006
**Kuhlthau, 1991**

### Model of the Information Search Process

<table>
<thead>
<tr>
<th>Initiation</th>
<th>Selection</th>
<th>Exploration</th>
<th>Formulation</th>
<th>Collection</th>
<th>Presentation</th>
<th>Assessment</th>
</tr>
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<tbody>
<tr>
<td>Feelings (Affective)</td>
<td>Uncertainty</td>
<td>Optimism</td>
<td>Confusion</td>
<td>Frustration</td>
<td>Doubt</td>
<td>Sense of direction / Confidence</td>
</tr>
<tr>
<td>Thoughts (Cognitive)</td>
<td>vague</td>
<td>focused</td>
<td>increased interest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actions (Physical)</td>
<td>seeking</td>
<td>relevant</td>
<td>Exploring</td>
<td>information</td>
<td>seeking</td>
<td>pertinent</td>
</tr>
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**Increased self-awareness**
Self-Determination Theory

Competence
need to be effective in dealing with environment

Autonomy
need to control the course of their lives

Humans' three basic needs

Relatedness
need to have a close, affectionate relationships with others
Cross-pollination

Sociotechnical, iterative, “third space” in which social construction enhances and re-triggers interest

Development of Relatedness leading to Competence leading to Autonomy

Triggered, Situational Interest

Maintained, Situational Interest

Emerging, Individual Interest

Well-developed, Individual Interest

Collaboration

Initiation Selection Exploration Formulation Collection Presentation Assessment

Feelings (Affective) Uncertainty Optimism Confusion Frustration Doubt Clarity Sense of direction/Confidence Satisfaction or Disappointment Sense of accomplishment

Thoughts (Cognitive) vague focused increased interest

Actions (Physical) seeking relevant Exploring information seeking pertinent Documenting information

Increased self-awareness
Conclusion
Thank you very much!